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The Buffalo Convention

We have now received what is thought to be virtually a complete set of the preprints of the Papers presented at the Buffalo Congress of the American Foundrymen's Association. The Second Annual Foundation Lecture, which is the equivalent of the British Edward Williams Lecture, was delivered by Dr. H. W. Gillett, and was the subject of appreciative comment in this column earlier this year. Of other general-interest Papers were two dealing with the properties of moulding sand. Both were by the same authors, Mr. H. W. Dietert, Mr. R. L. Doelman and Mr. R. W. Bennett, and the first carried the title "Mould Surface Properties at Elevated Temperatures." The second was on the related subject of "Mould Surface Gas Pressure."

By means of a new type of apparatus which determines the spalling properties of sand, it was established that these tests furnish a practical means of ascertaining the thermal stability. In confined expansion tests, a diminution of this property was caused by additions of silica flour, coal dust, core oil and cereal binders. When the mould surface of greensand is subjected to the heat of molten metal, a hot strength of the order of ten times greater than the green strength is produced within the first minute, but with dry-sand moulds, the strength is initially quickly reduced, but on continued heating dry sand develops an increasing hot strength. The second Paper was concerned with the problems of where the pressure of the gas generated by the mould is greater than that created by the molten metal, then the gas passes in to the casting and *vice versa*. There are still many difficulties to be overcome before a proper appreciation of this subject is obtained, not the least of which is the determination of mould permeability at elevated temperatures, but now that a back pressure control test has been established, progress leading to the elimination of blows, seams and penetration defects should be rapid.

Mr. Leighton M. Long was responsible for an interesting short Paper on "Melting Non-ferrous Metals in the Cupola." Success for the process, which shows such outstanding advantages for the mass-production foundry, depends upon the substitution of foundry coke by a coke made from coal-tar pitch. The special cupola used has a 42-in. shell lined down to 26 in. It incorporates 4 fours of 6 sq. in. area, set 16 in. above the hearth and 52 in. below the charging door. The stack is carried 20 ft. above the charging door. The blast used is 700 cub. ft. per min. at 4 ozs. pressure. The shell and stack are lined with firebrick, but to a point 28 in. above the tuyeres an inner silicon carbide lining is used. Each charge weighs between 400 and 450 lbs., and a coke ratio of 1:20 is used. This yields a melting rate of about 22 cwts. an hour, and runs of 16 hrs. are quite possible. The metallic losses can best be shown by citing an alloy containing 83 per cent. copper, 7 per cent. lead and 3 per cent. zinc will lose 1.05 per cent. lead and 1.50 per cent. zinc; there is no loss for either copper or tin. Obviously the tap-hole should be canopied and served by a high-velocity exhaust. We hope to deal with the salient points of the other Papers presented in future issues.

Mr. A. F. Cross, sales engineer on the London office staff of British Insulated Cables, Limited, has completed 50 years' service with the company. At a recent ceremony he was the recipient of a cheque for £50, presented on behalf of the company by Mr. T. H. Martin-Harvey, the deputy chairman. Mr. Cross has spent the whole of his service at the London office. Similar awards for 50 years' service have also been made recently to MR. R. ROGERS, of the head office staff, Prescot, and MR. J. TWEEDLE, MR. A. BRIERLEY, and the widow of MR. EDMOND HILL, of the Helsby works.

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NOTES FROM THE BRANCHES

London Branch—Before the December quarterly Council meeting, held at the Waldorf Hotel, an informal luncheon was held to honour one of the most distinguished members of the Branch, Dr. W. T. Griffiths, and a Branch past-president, Mr. J. W. Gardom. The former is now President of the Institute of Metals, and the latter President of the Institute of British Foundrymen. Mr. A. J. Murphy, M.Sc., presided, as the Branch President, Mr. J. F. Kayser, who sent a congratulatory cable, is still in America. The function also marked the achievement of a membership of just over 500. Dr. Griffiths' health was proposed from the chair, and that of Mr. Gardom by Mr. G. R. Webster.

South African Branch (Cape Town Section)—At the last meeting to be reported, Mr. L. Rowley presiding, a presentation of books made by the Council of the South African Branch was handed to Mr. Zwanziger, the honorary secretary and founder of the Section. Owing to illness, a lecture on "Industrial Photography" by Mr. J. D. Fisher was replaced by a general discussion on grinding wheels.

South African Branch—The September meeting, held in Johannesburg, Mr. P. L. Ward presiding, listened with much interest to a Paper on "Technical Training of Apprentices" by Mr. R. B. Spiro. The discussion which followed was of outstanding interest, as foreign systems were included.

FALKIRK LIGHT-CASTINGS INDUSTRY

A decision to form an Industrial Development and Full Employment Council to cover the Falkirk area was made at a meeting in Falkirk of representatives of local authorities, employers of labour, and trade unions. Capt. H. J. Kennard, R.N., said that when the war started the light-castings industry gave a lot of its labour to other industries. At the moment the industry in Falkirk was short of labour, and particularly key men, but the employers were in consultation with the Secretary of State and local members of Parliament. The industry had a plan for the future, but, with key men away, it was difficult to make alterations. Several of the foundries were being used as stores, and certain plant had not been used for two or three years. There had been almost a revolution in housing needs so far as the light-castings industry was concerned.

NEW STANDARDS

A recent issue of the Monthly Information Sheet issued by the British Standards Institution contains the following items of interest to our readers. New work is being started in "pipe fixings, fixings for corrugated roofing sheets, sundry hooks, special nails, etc.," and a draft standard has been issued: "C.G.(B.) 8036, Draft B.S., for kitchen fitments and equipment."

CORRESPONDENCE

[We accept no responsibility for the statements made or the opinions expressed by our correspondents.]

AN AMERICAN TECHNICAL MEETING

To the Editor of THE FOUNDRY TRADE JOURNAL.

SIR,—Last night I had the pleasure of attending a meeting of the Metropolitan Chapter of the American Foundrymen's Association and of conveying to its members fraternal greetings from our London Branch and from you and the rest of the staff of THE FOUNDRY TRADE JOURNAL. Mr. T. D. Parker, chairman of the Chapter, asked me to convey to England the best wishes of the American Foundrymen's Association, and to say that they are all looking forward to the arrival of happier times when we may all meet at an Anglo-American Convention, either in the U.S.A. or in England.

The purpose of yesterday's meeting was to listen to a talk about metal patterns by Vaughn Reid, President of the City Pattern Foundry & Machine Company, Detroit. It was held at the Essex House, Newark, N.J., and was attended by rather more than 100 members. All members and guests met for dinner at 7 p.m. and the "talk" started at 9 p.m.

"Talk" and questions were well up to the high standard so characteristic of foundrymen's meetings all over the world, and the evening wound up happily at about 10.45.—Yours, etc.,

J. FERDINAND KAYSER,
President, London Branch,
Institute of British Foundrymen.

Ritz-Carlton Hotel,
Madison Avenue and 46th Street,
New York.
November 7, 1944.

IRONFOUNDRY FUEL NEWS—XXXI

Reports received by the Ironfounding Industry Fuel Committee would indicate that some founders are not clear as to the reasons for the probable shortage of coke during the coming months. It is apparently felt that as long as supplies of town's gas and coke oven gas are maintained for industrial and domestic consumers, the supplies of coke should be maintained accordingly. That this argument is unsound is clearly shown by figures given in the recent White Paper presented by the Minister of Fuel and Power. It is demonstrated that gasworks are producing increasing quantities of gas from gas oil, as distinct from coal, and no coke is, of course, produced from this process. The consumption of gas oil in gasworks has increased between 1938 and 1943 by 60 per cent. In addition, the amount of water gas produced (from gas coke) to supplement the town's gas supplies has increased by 50 per cent. over the same period.

The above factors, combined with the shortage of coking coals, should explain any shortage of gas coke, which shortage would, of course, be reflected in the hard coke supply position because of the amount of substitution which would take place.

THE PRODUCTION AND FOUNDING OF INOCULATED HIGH-DUTY CAST IRON*

Co-operation of the designing, pattern-making, founding and metallurgical departments

By J. L. FRANCIS, A.M.I.Mech.E.

In ironfoundries the cupola is far more generally used than any other kind of melting furnace. Throughout these notes, therefore, the melting practice is based on this unit. High-duty cast iron, as discussed here, refers to material able to fulfil the requirements of B.S.S. No. 786, which covers a tensile strength of from 15 to 25 tons per sq. in. obtained from an 0.875 in. dia. separately-cast test-bar, machined to 0.564 in. dia., and has special reference to pressure-resisting material. The tensile figures are minimum values, and it will be seen that in some cases higher mechanical properties can be obtained. These cast irons are dense and close-grained with a specific gravity ranging from 7.4 to 7.6.

It is emphasised, in passing, that in order to make high-duty irons satisfactorily and economically in the cupola, everything connected with operating the furnace and melting the charges must be beyond reproach. Cupola design and operation is a subject sufficient for a Paper by itself. Indeed, it has formed the title of very many excellent Papers, and as it cannot be dealt with here, a study of the subject is recommended. Correct cupola practice and a melting technique based on proper scientific control are essential requirements, especially when steel scrap forms a substantial part of the charges.

FIG. 1.—SHOWING FERRITE GRAINS AND GRAPHITE FLAKES AT 500 MAGNIFICATIONS.

Unalloyed Grey Irons

To produce cast irons of the high-duty class, it is by no means essential to resort to the use of alloying elements such as nickel, chromium, molybdenum, or similar materials. Undoubtedly the judicious use of these rarer metals will impart increased mechanical properties and effect improvement to irons already of high-duty quality, but it should be distinctly understood that they are not indispensable. Unalloyed irons are capable of fulfilling all the requirements of a large range of high-duty castings. In these cases there is little point in adding alloys to give properties in excess of those needed. They should be employed only where it is desired to develop special characteristics such as may be derived from their use alone.

Omitting the special elements, there remain those common to all cast irons, namely, carbon, silicon, manganese, sulphur, and phosphorus. They are also present in the various grades of steel, but for the most part in smaller quantities, particularly in respect of carbon, which for steel, is limited to a maximum of 1.7 per cent., whilst for cast iron it commences at this figure and may extend to about 4.0 per cent.

Most of the carbon, in grey cast irons, separates as graphite, forming flakes and thereby breaking up the continuity of the metal matrix. The matrix may be ferrite, pearlite, or, in white irons, cementite. Fig. 1 shows ferrite grains and flake graphite at 500 magnifications. For high-duty irons, the all-pearlitic structure is aimed at. Pearlite is composed of ferrite and cementite in alternate layers, as shown in Figs. 2 and 3 at 500 and 1,500 magnifications respectively. A modified form of unlaminated pearlite is known as sorbite. An example of a white iron structure composed of cementite and pearlite is shown in Fig. 4. Ferrite, with silicon in solid solution, has a tensile strength of about 28 tons per sq. in. Pearlite, in its coarser formation, records about 40 tons per sq. in. Finely laminated, or sorbitic pearlite, such as is obtained by heat treatment, gives a tensile strength of around 80 tons per sq. in. It appears, therefore, that were it not for the strength reducing effect of the non-metallic graphite, and other non-metallic constituents, cast iron could be produced approaching more nearly to the

* A Paper presented to the East Midlands Branch of the Institute of British Foundrymen, Mr. F. G. Butters presiding.

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limit of 80 tons per sq. in. imposed by the strongest structural component, namely, pearlite.

Effect of Graphite

Graphite has a specific gravity of 2.255, less than one-third that of cast iron, so that it occupies a volume in the structure at least three times as great as its weight. Any process for increasing the strength of cast iron must therefore be concerned chiefly with the control of the quantity, distribution and form of graphite. Flinn and Reese[1] produced the diagrams shown in Fig. 5 to illustrate the effect of graphite distribution. Provided the quantity is constant and dispersed at random throughout the matrix, in flake form, the number of flakes has no major effect on the matrix because the volume of the latter remains constant also. Manner of distribution is the main factor of importance, as, for example, in case D, where the

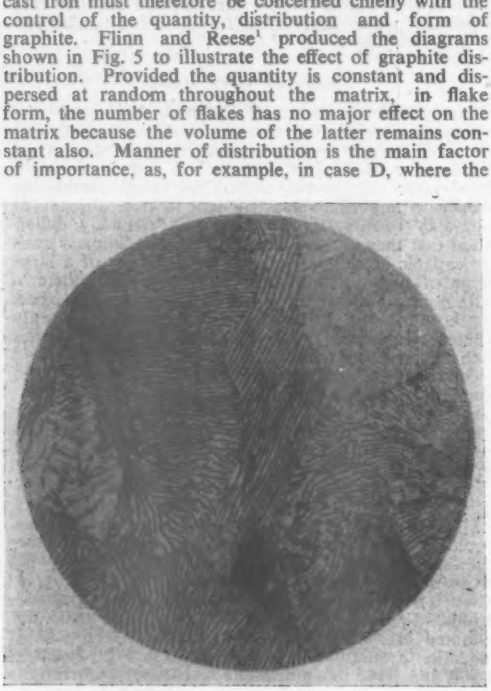

FIG. 2.—SHOWING THE LAMINATED STRUCTURE OF PEARLITE CRYSTAL GRAINS AT 500 MAGNIFICATIONS.

flakes are smallest, but arranged at the crystal grain boundaries. Evidence showing a strength decrease accompanying an increase in size of the graphite flake is claimed to be due in reality to the fact that the slower cooling which produces the enlargement of the graphite also coarsens the grain size of the material forming the matrix and at the same time lowering the combined carbon.

With pearlitic matrix cast irons the amount of graphite present in the structure depends entirely on the total carbon ratio. Consequently, it is essential, where maximum strength is sought, to keep this to a minimum. For cupola melted irons the minimum total carbon content which can be obtained regularly and without undue difficulty is around 2.8 to 3.0 per cent. Lower figures than this can be reached by adopting a very exacting system of control, but the advantage so gained is likely to be more than offset by the greater casting difficulties, and tendency towards shrinkage trouble to which such low-carbon iron is liable. Whatever the grade of cast iron in production the requirement of primary importance is that sound castings must be made from it. A high-duty material, able to give exceptional results as a test-bar is of less value than a weaker iron if castings made from the former contain defects arising from its less favourable casting qualities, such as are not encountered with the latter.

Use of Steel Scrap

Employing steel scrap as part of the charge is a ready means of exerting a measure of control over the

FIG. 3.—PEARLITE GRAINS AT 1,500 MAGNIFICATIONS.

total carbon. It acts as a diluent to the elements present in the rest of the charge materials, dependent on the ratio used. Unfortunately, its use is not so simple a matter as appears at first sight. Cupola practice and melting technique have to be modified and standardised on suitable lines. Taking the coke used for fuel as one single item, this alone requires a preliminary study to determine the grade size and quantity best suited to give metal of maximum temperature with a high speed of melting and a minimum carbon

pick-up. Once these points have been settled satisfactorily, they should be made standard and strictly adhered to, other items being dealt with on similar lines.

Where steel scrap and pig-iron or cast iron are part of the charge, the latter should not be of high-phosphorus content, because of the large difference in melting point of the two materials, which tends towards non-uniformity of composition. Alteration to the chemical composition of the mixture is not in simple proportion to the quantity of steel used, due to a variation between melting gains and losses. This is particularly the case with the total carbon and even when using charges composed of all steel scrap, carbon pick-up during passage through the furnace is sufficient to bring the value up to something in the neighbourhood of 2.5 per cent., according to operating conditions. Even if such were not the case, total carbons of lower than about 2.8 per cent. are not necessary. That other factors besides high tensile strength have to be taken into consideration has already been stressed. Production of sound castings is not least among these and, moreover, the nearer cast iron approaches to steel compositions, the greater its tendency to lose its valuable characteristics as cast iron. Some of these can be stated as low cost, simplicity of production, ease of casting, high endurance ratio or low notch sensitivity, good vibration damping capacity, ready machinability, self-lubrication and rigidity. It is seen, then, that in striving after high-duty material these valuable attributes inherent in ordinary cast iron must not be sacrificed too greatly in order to achieve properties already available with steel castings.

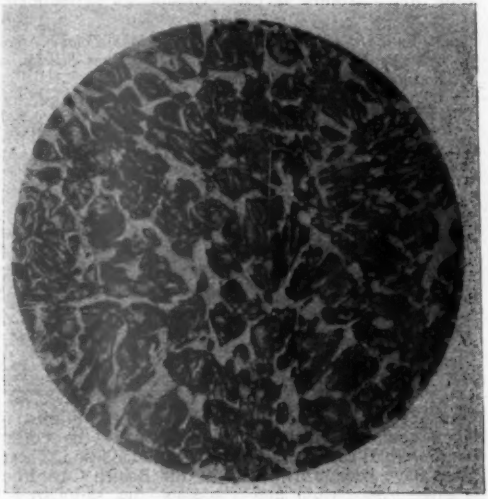

FIG. 4.—WHITE IRON STRUCTURE SHOWING CEMENTITE AND PEARLITE AT 150 MAGNIFICATIONS.

Another complication arising from the use of steel scrap and irons of low-carbon content is the formation of what is termed a dendritic structure, combined with graphite dispersed in the grain boundary, reticular or under-cooled form, similar to that of diagram D in Fig. 5. All these drawbacks to the use of steel scrap in the cupola charge may appear to constitute a serious deterrent. However, simple and ready means of overcoming them are available, due to investigational work on the subject done both here and in the U.S.A.

Dendritic Structure and Under-cooled Graphite

It is understood that all cast irons solidify with a dendritic structure, but that such is not so readily apparent with the higher carbon irons. With carbon contents of 2.7 per cent. or lower, the primary dendrites are more easily seen, because they occupy a greater proportion of the total metallic matrix, and also because they are not so equi-axed as those forming from irons of over 3.0 per cent. total carbon content. The more pronounced type of dendritic structure found in low-carbon irons is associated with lower mechanical properties, particularly with respect to impact or shock resistance, and this weakness is augmented by the tendency of the graphite to separate in the fine under-cooled condition. Controversy exists regarding the terms used to describe the fine graphite which is formed by under-cooling and, indeed, also for that of the flake variety present in the majority of grey-iron structures. For the former, the expressions

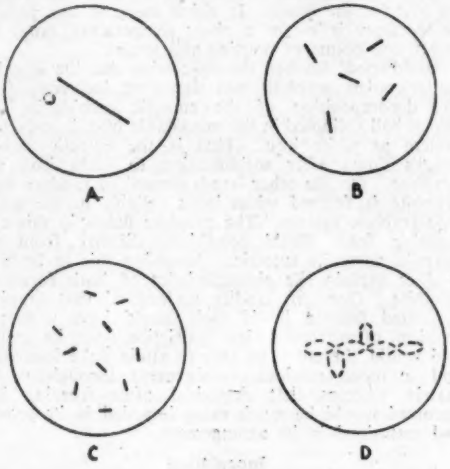

FIG. 5.—FLINN AND REESE'S DIAGRAM SHOWING DIFFERENT FORMS OF GRAPHITE DISTRIBUTION.

Inoculated High-duty Cast Iron

grain boundary, reticular, inter-dendritic, eutectiform, and under-cooled, have all been applied and criticised. Similarly, for the more usual flake size, the terms normal and random have been used. Accurate nomenclature which allows of no confusion is a valuable asset, but the main thing so far as production of high-duty iron is concerned is to know the kind of structure associated with maximum mechanical properties and how to obtain it, and, conversely, that causing weakness and how to prevent it.

Norbury[2] has shown that for any given composition of cast iron the primary dendrites become longer and more pronounced the higher the pouring temperature. At lower pouring temperatures their number increases, and they become smaller and more equi-axed. High-steel scrap ratios in the cupola charges are conducive to hotter melting and lower carbon contents, both of which are factors favouring a pronounced dendritic formation. Pouring temperature is a relative expression as applied to high- and low-carbon cast irons, since a high pouring temperature for the former might be low for the latter. In either case, by low pouring temperature is meant a short temperature range between the points of pouring and setting.

Braidwood[3] reached the conclusion that the so-called under-cooled graphite was deposited indirectly from the decomposition of the eutectic carbide in irons which had solidified in the metastable iron, iron-carbide system as white iron. That is, the eutectic carbide breaks down after solidification to form iron and graphite. On the other hand, normal or random flake graphite is formed when irons solidify in the stable iron-graphite system. The graphite flakes in this case forming from liquid conditions directly from the graphite-austenite eutectic. Assuming this to be true, it does explain the characteristics of both forms of graphite. One can readily understand that graphite deposited from a liquid melt would have a greater freedom of movement, less restriction upon its growth and would, therefore, be able to attain flake formation and a more random arrangement throughout the matrix, whereas that deposited after freezing had occurred would be much more impeded in its growth and restrained in its arrangement.

Inoculation

Having established the fact that it is necessary to keep to the lower carbon ranges for the production of high-duty cast irons, and that these alloys tend to solidify with a pronounced dendritic structure and with under-cooled graphite, both detrimental to the development of maximum mechanical properties, the problem arises of how to avoid these drawbacks and to obtain normal flake graphite under all casting conditions. The solution is to treat the melt in such a way that it is induced to freeze under the stable iron-graphite system, thereby obtaining normal graphitisation. For a long time it has been known that the addition of certain materials in crushed form to the molten iron will have the desired effect, and the technique has been termed inoculation. Here, again, the term has not escaped criticism, but none more suitable has been adopted up to the present.

Quite a number of different materials, both singly and in combination, have proved effective as inoculants. There is, however, much scope for more work in this field. It is known that the effect of inoculation is more pronounced in the lower carbon ranges. Even with medium carbon irons the process is valuable, although showing less improvement, because, although the graphite formation may be predominately random, the surface often is markedly dendritic. Inoculation treatment in these instances ensures the best graphite structure completely throughout the casting.

Another aspect of the inoculation treatment as a means of producing high-test cast iron is the fact that the effect of the inoculant added directly to the molten iron is very much more potent than if the same material in like quantity were added by way of the solid charge. This makes it possible to take advantage of lower silicon compositions which would not give ready machinability if cast without such treatment.

TABLE I.—*Safe Silicon Limits for Various Total Carbon Contents Prior to Inoculation with Calcium Silicide at Rate of* 100 *to* 120 *ozs. per ton.*

Total Carbon, per cent.	Silicon for 1.2-in. dia. Bars.	Silicon for 0.875-in. dia. Bars.
3.6	0.50	0.75
3.5	0.55	0.80
3.4	0.60	0.85
3.3	0.65	0.90
3.2	0.70	0.95
3.1	0.75	1.00
3.0	0.85	1.15
2.9	1.00	1.30
2.8	1.10	1.40
2.7	1.20	1.60
2.6	1.45	1.80
2.5	1.65	2.05

In this respect, Table I is of interest, showing minimum silicon contents which should accompany the corresponding total carbon ratios prior to inoculation. These values have been worked out by the British Cast Iron Research Association and represent the safe lowest limits at which silicon can be held in order to obtain machinable structures when inoculation is performed with calcium silicide at the rate of 100 to 120 ozs. per ton. This raises the question as to what are the quantities of inoculant to add in order to achieve the best all-round results.

Quantities of Inoculant

Involved in this question are the type and composition of the inoculant in use and the carbon equivalent of the iron undergoing treatment. Before progressing further, it will be as well to define what is meant by the expression "carbon equivalent." As is well known,

the eutectic composition of the pure iron-carbon alloys is obtained with 4.3 per cent. of carbon. No commercial cast iron is a pure alloy of iron with carbon, but contains also silicon, manganese, sulphur and phosphorus in varying amounts. The presence of these alters the proportion of carbon required to form the eutectic. Put another way, they replace carbon to some extent and for practical purposes one unit of silicon and phosphorus are each credited with being equivalent to 0.3 per cent. of a unit of carbon, the sulphur and manganese being neglected. Thus, an iron containing 1.0 per cent. each of silicon and phosphorus and 3.0 per cent. of total carbon would have a carbon equivalent of 3.6 per cent. calculated on this basis.

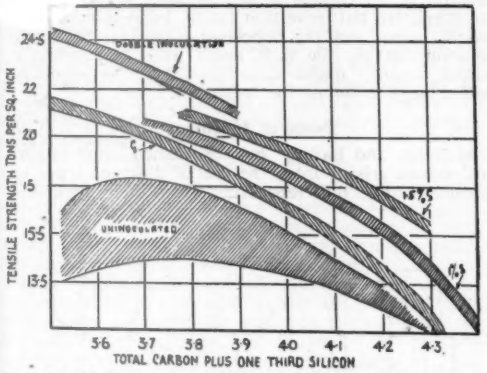

FIG. 6.—MCELWEE AND BARLOW'S DIAGRAM ILLUSTRATING EFFECT OF COMPOSITION (AS INDICATED BY TOTAL CARBON PLUS ⅓ SILICON) ON THE TENSILE STRENGTH OF GREY CAST IRON USING GRAPHITISING AND STABILISING INOCULANTS.

These curves indicate the increase in properties obtained from inoculation with material reduction in the variation in properties for any given analysis. They also indicate the difference in the effective range covered by the graphitising and stabilising types of inoculant. The double inoculation curves show the results obtained by using a graphitising and stabilising inoculant simultaneously. This has proved effective with low carbon equivalent irons. These curves may have slightly different numerical values in some foundries, but furnish a very close approximation for the majority of grey-iron foundries at present. Addition of alloying elements such as chromium, vanadium, molybdenum, nickel and copper, changes the numerical value of these curves, but not the general trend.

Inoculating Medium

There is little doubt that the majority of inoculation processes employ the silicon bearing or softening type of inoculating medium. The principle involved here is to run an iron of as low carbon equivalent as possible for the work in hand and to add an inoculant of the softening type to impart machinability and the desired mechanical properties. An extreme example of this is the use of such an inoculant for converting white iron to grey without annealing. It is possible, however, to work in the reverse direction and to stiffen up a high-carbon equivalent material by means of a stabilising or hardening inoculant. Further remarks concerning this latter will be made later.

Tests With Graphitising Inoculants

Lownie[4] has made some interesting tests using graphitising inoculants, such as 94 per cent. ferro-silicon and a 75 per cent. silicon alloy with 7 per cent. of manganese and 7 per cent. of zirconium on an iron containing 3.05 per cent. total carbon, 2.01 per cent. silicon, 0.88 per cent. manganese, 0.114 per cent. sulphur and 0.172 per cent. phosphorus which gives a carbon equivalent of 3.7 per cent. He concludes that irons which show most benefit from inoculation lie between the carbon equivalencies of 3.35 to 3.77 per cent., and for preference the carbon equivalent should be around 3.72 per cent. or below. After inoculation the carbon equivalent of these irons should not be raised to more than 3.60 to 3.80 per cent. if the maximum benefit is desired. Further, his results indicated that the quantity of silicon required to yield optimum properties generally decreases as the carbon equivalent increases.

Additional information is supplied by McElwee and Barlow,[5] who state that in their experience with the use of a softening inoculant containing silicon, calcium and titanium, amounts normally range from 36 to 72 ozs. per ton. Less than 36 ozs. per ton is not sufficient to guarantee complete transformation of the reticular graphite, whilst more than 72 ozs. is unnecessary, unless a great deal of chill reduction is needed. As an example of the latter case, up to 180 ozs. per ton may be required in order to convert a completely white section to a grey one without the help of annealing. Table II gives some quantities of the softening type of inoculant which have been used in practice under varying conditions:—

TABLE II.—*Quantities of Graphitising Inoculants used in Practice under Varying Conditions.*

Carbon Equivalent.	Inoculant used.	Ounces per ton.	Silicon content of Inoculant.	Mesh size.
			Per cent.	
3.75	Si, Mn; Br	168	75	−6 +80
3.824 ..	Fe–Si ..	40	80	−16
3.824 ..	Ca Si ..	40	60	−16
3.824 ..	Al Si* ..	40	50	−16
3.824 ..	Al swarf*	12	—	−16
3.89	Fe–Si ..	180	80	−¾
3.40 to 3.70	Fe–Si ..	180	50	−¾
3.40 to 3.70	Fe–Si ..	210	85	−¼
3.28	Si bearing	80	70	−16
3.00 to 3.75	Ca–Si ..	100 to 120	60	−16

* W. Barnes and C. W. Hicks.[3]

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Action of Inoculants

Table II may form a guide as to the quantities of inoculating materials to employ under different circumstances, but it certainly discloses the fact that the amounts are far from standard. This is most likely because of the different nature of the irons undergoing treatment and the varying properties it is wished to develop as well as to the diversity in sort and size of the castings produced. Other substances besides those listed are used, and one notable omission is carbon. Carbon is employed most conveniently in the form of crushed graphite electrode.

Argument has centred about the mechanism of the changes which inoculants of the type described exert upon low-carbon cast irons. Various theories have been put forward, and no final or definite conclusions have yet emerged. One thing which is certain, however, is the fact that successfully inoculated irons are less susceptible to undercooling and its associated graphite formation. A study of rate of cooling upon graphite deposition has revealed that quick cooling tends to produce undercooled graphite and the change from normal flake graphite to very fine graphite in recticular arrangement is a gradual transition, controlled principally by the degree of undercooling experienced. Treatment with inoculating materials has the effect of extending the degree of undercooling which can take place without the production of reticular graphite. In other words, irons so treated have a much greater tendency to graphitise in the normal form than material of the same composition not so treated.

Although conclusive proof of the manner of formation of the different types of graphite may not be available, the differences between normal random flake graphite and the fine undercooled variety undoubtedly signify that their mode of formation is not basically the same. In this respect Eash[6] has shown that reticular graphite is deposited after solidification of the iron-iron-carbon eutectic whereas normal randomly dispersed graphite separates out from liquid conditions. Thus one effect of inoculation is to cause graphitisation at the eutectic point when it would normally take place below this point in the untreated material. That is to say, inoculation actually changes the process of solidification, but, as pointed out, the reasons why inoculants act in this way are the subject of much theorising. Having exerted their effect in preventing formation of undercooled graphite, inoculants of the softening type have little influence on the way the normal graphite formed as a result of this treatment is distributed. Pouring temperature is the controlling factor with regard to graphite distribution throughout the matrix, since, as mentioned previously, it decides size and orientation of the primary dendrites.

A popular theory is that attributed to Piwowarsky, which deals with the formation of nuclei within the melt, these nuclei providing centres of crystallisation and inducing separation of the graphite. It appears to the Author that inoculants of the graphitising class may act in the way described below. Low-carbon irons such as discussed here, are all of hypo-eutetic composition. When an inoculant containing carbon silicon or similar graphitising agent is introduced into the melt the liquid iron in its vicinity takes it into solution and becomes locally hyper-eutectic to such degree that free carbon is immediately expelled from solution in a very finely divided form. Then dispersing throughout the bulk of the liquid iron it forms centres of crystallisation and induces further deposition of graphite. The fact that the effect of inoculation wears off if the melt is left standing for too long a time after treatment can be explained by diffusion of the inoculant. Given enough time it will attain equal concentration in all parts of the melt, and as the quantities are small in relation to the volume treated its effect would become so attenuated that reversion to the hypo-eutectic state would occur, and the deposited nuclei go back into solution, leaving the melt much as it was, when it would solidify under conditions such as obtained before application of the treatment.

Types of Inoculant

McElwee and Barlow[5] have published some important results arising from the use of different types of inoculant. Fig. 6 is reproduced from their work and

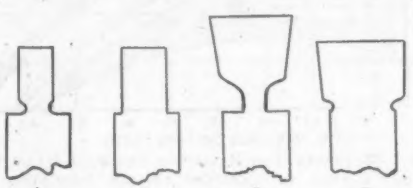

FIG. 7.—TYPES OF FEEDING HEADS OF CIRCULAR CROSS SECTION.

deals with the effect of a graphitising or softening inoculant, a hardening and densifying inoculant of the carbide stabilising type and the results derived from a combination of the two. The former material contains silicon, calcium and titanium, whilst the latter includes as well stabilising elements such as chromium and manganese. From Fig. 6 it appears that softening inoculants may be more economical in low-carbon equivalent irons, judged from tensile strength values alone, while for higher carbon equivalents the stabilising types are superior. Other considerations are concerned, however, and may outweigh tensile strength in importance. Stabilising inoculants increase the hardness and density in all compositions of cast iron, whereas the graphitising medium normally reduces hardness. In the case of a heavy sectioned casting, even with a low-carbon equivalent iron, it might be necessary to use the stabilising inoculant to ensure sufficient density and hardness.

At the other extreme, a casting could be so thin that, with an iron of over 3.9 per cent. carbon equivalent, it would need a graphitising inoculant to guard against high hardness. Apart from these special cases, it may be taken generally that low-carbon equivalent irons which would, without treatment, solidify with fractures from all white to slight mottle, need an inoculant of the graphitising kind, whilst higher carbon equivalent irons, which would tend to include free ferrite in their unmodified structures, require the stabilising inoculant. Both types can be used in combination for treatment of low-carbon equivalent irons, resulting in especially high mechanical properties, as indicated by the "double inoculation" curve of Fig. 6.

When using the stabilising inoculant of McElwee and Barlow, somewhat larger quantities are needed than for the softening type. The minimum effective quantity is about 0.5 per cent., although 1.0 per cent. is an average for producing full inoculation effects. Since its composition is balanced, considerable quantities of chromium may be introduced by using amounts in excess of those needed for inoculation, without increasing the tendency to chill.

The Two Cupola Process

What has been termed the two-cupola process by Judson[7] is in reality another method of producing high-duty cast iron by inoculation. Since, as its title implies, it requires two cupolas melting simultaneously, it is an economical process only under special circumstances. Briefly, it consists of running a white iron in one cupola and a soft grey iron in the other. Additions of the soft iron are made to the hard iron in the ladle in proportions best suited to the pressure castings to be made. The white iron is produced from graphite-free charge materials, such as steel scrap, and the addition to it of the soft graphite containing iron is equivalent to introducing an inoculant. A further similarity lies in the fact that the grey iron must be introduced as short a time before casting as possible, as otherwise the graphite has sufficient time to coarsen. It is also of interest to record that Judson found with iron of total carbon content between 2.50 and 2.70 per cent., it was necessary to maintain the silicon at 1.4 per cent. minimum in order to be sure of securing an all-grey structure in a 1½ in. dia. test-bar.

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(To be continued)

B.I.C.E.R.A. ACQUIRES LABORATORY FACILITIES

Prior to the war more than two out of every three petrol, oil or gas engines made in Great Britain, other than those for road vehicle or aircraft use, were exported. The war effort of our engine builders can, as yet, be assessed only by a very few, but it has been of tremendous proportions. It is apparent that this industry has been of great commercial value; it can be of much enhanced national importance, provided we can offer to the world the right articles at truly economic prices.

The key to that possibility is research, conducted in an organised way, properly co-ordinated with associated efforts, and on a basis covering the whole industry. It was to meet just this need that the non-profit-making British Internal Combustion Engine Research Association (B.I.C.E.R.A.) came into being in 1943. Almost every manufacturer is a member of the Association; its sphere covers stationary and portable internal-combustion engines of all sizes, marine engines up to 1,500 h.p., and power units for railway traction purposes. They operate on any liquid or gaseous fuels, or combinations of the two.

A notable step forward has recently been taken by the Association in obtaining laboratory premises, equipment and a number of skilled personnel, ready for immediate service, and with room for expansion. The group of buildings is at Buckingham Avenue, Slough, Bucks, and has been used for engine development work for seven years by a private concern. Not only is direct research already in actual progress there, but liaison with other bodies, both national and private, increases the volume and value of this work.

The subjects for research are all of general value to this large section of the internal combustion engine industry, and makers' own research development work carries on as before, but with the backing of the Association's information service and complementary activities. Thus the nation's present needs for large numbers of internal combustion engines in a multitude of forms—for landing craft, other special vessels, mobile power stations, and tanks, to mention but a few war uses, have encouraged co-ordinated research on a much broader basis than heretofore. This principle is now in active operation under B.I.C.E.R.A., for the benefit —in peace as well as in war—of an industry which forms a most important section of British mechanical engineering.

By spraying metal parts in an electrostatic field uneven distribution of the paint film is eliminated, resulting in an improved finish of uniformity and smoothness. Using higher potentials than in electroplating, 100,000 volts, paint particles acquire a charge as they enter the electrostatic field, and are instantly attracted to the part being sprayed. A descriptive article on the subject has appeared in a recent issue of the "Iron Age."

PLASTIC IMPREGNATION OF MAGNESIUM CASTINGS*

Magnesium castings used in aircraft engines have innumerable tiny holes which must be impregnated and sealed in order that the gases of combustion and lubricating oils be retained. Tung oil† has been generally used as a casting sealer. Recently its use as such has been denied by the W.P.B. Other drying oils have taken the place of tung oil, but not with the same degree of success. Sodium silicate also has been tried, but this material has the disadvantage of being water soluble and abrasive in nature. Cutting tools are, therefore, more easily dulled, which, in the case of magnesium metal, may present a fire hazard during fast machining operations. Hydrofluoric acid as a cleaning agent for magnesium tends to etch the silica within the metal casting, thus causing porosity to re-occur.

A new synthetic resin has been developed which is claimed to have advantages over tung oil as a casting sealer or impregnant. This resin is manufactured by Ault & Wiborg, Division of Interchemical Corp., Cincinnati, and is known as their No. 988 metal impregnating compound. It is a 100 per cent. non-volatile compound, and has a viscosity of Y-Z on the Gardner-Holdt scale (18-23 poises).

Resin Mixed with Styrene

The impregnating solution is prepared by mixing the desired portion of resin with stabilised monomeric styrene. The resin has the outstanding property of co-polymerising or cross linking with the styrene molecule, forming a single molecule during curing, which has all the properties of its own, separate and different from either the properties of the resin or the styrene molecule.

The usual mixing proportion is equal parts by weight of resin and styrene, the mixture having a viscosity of approximately 35 poises. If the casting capillaries are small, more styrene is used in the mixture, about 40 parts resin to 60 parts of styrene. If the openings are large, the viscosity is increased by using a mixture of 60 parts resin to 40 of styrene.

The recommended impregnating procedure for sealing porous castings is the vacuum-pressure method whereby parts are placed in a large sealed tank, and a vacuum of approximately 27 in. is created to remove the air from within the castings. The vacuum is then broken by drawing the solution into the tank, completely covering all parts. Air pressure of 90 lbs. is then applied to force the liquid into the castings. The liquid is then drawn off and the castings allowed to drain. The excess coating is washed off either in a solvent cleaner such as kerosene or any suitable stabilised alkali cleaner. Impregnation may be done either before or after machining, the only precaution necessary is that the surfaces be clean and free of foreign matter, such as oil, grease, etc. It is recommended that the tank containing the impregnating solution be water cooled to maintain a constant temperature of 65 to 75 deg. F.

Curing or baking is done preferably under air pressure between 50 and 75 lbs. The resin-styrene solution has the property of converting from a liquid to a gel state within 40 min. at 125 deg. C., which may be regarded as a fast production cycle. The molecular size of both the resin and monomeric styrene are relatively small before co-polymerisation takes place during baking or curing. The low viscosity and small molecular size of the impregnating solution help achieve satisfactory penetration as well as drainage of excess material after impregnation.

Since the monomeric styrene not only acts as a solvent, but also is the co-polymer formed with the resin, there is very little subsequent solvent loss, about 1 per cent. under the above pressure.

The completely cured co-polymer has been found satisfactorily resistant to high octane spirit and hot motor oil. However, the resin can be attacked by strong aromatic solvents. While monomeric styrene is reactive, it is stabilised by the manufacturers (Dow Chemical Company) to be non-reactive over a prolonged period of time. The resin-styrene solution is reactive, too, but is considered sufficiently stable for normal factory working cycles. There are no fire hazards connected with either the mixing or storage of both the resin and the monomeric styrene, other than expected normally of paints and varnishes.

* From an article in the "Iron Age."

† For information on impregnating magnesium castings with tung-oil see "New Tung-oil Method of Testing Magnesium Castings," FOUNDRY TRADE JOURNAL, January 6, 1944.

COKE IN SHORT SUPPLY

The Minister of Fuel and Power announces that, owing to increased requirements of coke for essential war production and services connected therewith, the supply of coke for the ordinary industrial and domestic market must be restricted.

While programming of coke supplies on the same lines as coal supplies has been introduced in order to secure the most equitable distribution possible of the coke available, local shortages are likely to be unavoidable. All consumers are urged to exercise the utmost economy and to do all they can to conserve their existing stocks.

We have received a copy of "Problems in the Utilisation of Small Coals," published by the British Coal Utilisation Research Association, Rickett Street, London, S.W.6, price 15s. 7d., post free. The volume contains 28 Papers, together with discussions, presented at a conference held in November, 1943.

Mr. William O. McMahon, M.Sc., of Birmingham, Alabama, widely known foundry chemist and metallurgical engineer, has been appointed southern area technical consultant of the Gray Iron Founders' Society.

ACHIEVEMENTS IN THE DEVELOPMENT AND APPLICATION OF UNIFORM COST SYSTEMS

There is ample evidence of foundrymen's interest in uniform accounting

By G. C. STONE, F.C.W.A.

(*Continued from page* 318.)

Cost of Direct Materials

Different methods can be used to ascertain the cost of direct materials. These materials are usually comprised of those entering into an article and the primary packing essential for the handling of the finished product. Thus in the case of grey-iron foundries, remelt or home-made scrap can be included in the mixture cost either at the price of bought scrap or the price of the mixture from which it came. Foundries using several mixtures differing widely in cost may segregate the home-made scrap from each mixture and remelt it with the mixture from which it came. In these circumstances the home-made scrap can be included in the cost of the mixture at the average price of the other ingredients. Where only one mixture is used or home-made scrap is not segregated from bought scrap then one price can be used for both kinds of scrap. An example illustrating the application of the two methods mentioned is given in Fig. 1.

There is a serious need for a wider appreciation amongst foundrymen of the effect upon the cost of a job of the yield of saleable castings as a percentage of the total metal poured. This may be judged by some as an unnecessary refinement in methods, yet the effects of either using or ignoring it are typical of those between simple and scientific cost methods. When costs are prepared by the most advanced methods it is possible when competition is keen to use a small profit margin with confidence. Through his privileged position the Author is aware of classes of work which before the war consistently went to one foundry and other classes which uniformly went elsewhere mainly because of different methods of costing, yet these competitive firms were not aware of the reason. On gates, runners and scrap castings the metal poured is less than that charged into the cupola so that the loss due to melting as well as the cost of melting on these items are part of the cost of individual orders. An example illustrating differences in the cost of metal in saleable castings for different yields is given in Fig. 2.

The foundry costing on average yield attracts work with a low yield which is unremunerative without their being aware of it due to the nature of their costing system. The difference in the cost between a low yield for an order and the average yield for all orders is a substantial portion of an acceptable profit for work offered in big quantities especially if competition is keen. It would be an advantage to the foundry trade if this principle was recognised and applied.

As the main principle of costing for foundries every job or order ought to be costed separately. Several kinds of costing are known for foundries which are based on groups of castings. Generally these ought to be examined cautiously as it may be in rare cases only that they can be justified. One system groups castings by methods of moulding such as green sand, dry sand and loam and for each an average cost per cwt. is prepared. Another type may sub-divide each of these groups of moulding into (1) with cores; (2) without cores. An even further type of group costing is to have castings in groups each for a range of weights with several sub groups indicating degrees of intricacy for each weight group. The schedules, Fig. 3, *et seq*, illustrate the forms which have to be completed for these kinds of group costing. From this review of the lack of uniformity in methods of costing it can be realised that there can be many combinations of the various factors of costing mentioned, and each combination can produce a different cost for the same order.

	Alternative "A."						Alternative "B."			
	Metal per ton.			Mixture per ton.			Metal per ton.	Mixture per ton.		
	£	s.	d.	£	s.	d.		£	s.	d.
25 Pig-iron X ..	8	0	0	2	0	0	Same as for Alternative "A"			
20 Pig-iron Y ..	7	0	0	1	8	0				
25 Bought scrap ..	6	0	0	1	10	0				
5 Alloys	14	0	0	0	14	0				
75 Average price of purchased metals £5 12s. × 100/75 = £7 9s. 4d. ..	7	9	4	5	12	0	(as £6 for bought scrap)	5	12	0
25 Own scrap ..	7	9	4	1	17	4		1	10	0
100 Cost of metal in mixture				7	9	4		7	2	0

FIG. 1.—COMPARISON BETWEEN TWO METHODS FOR COSTING THE RE-USE OF DOMESTIC SCRAP.

Uniform Cost Systems

The various explanations in Fig. 4 have been made to reveal how urgent and vital is the need for uniform methods. Although the illustrations have been taken from the foundry industry, they are typical of conditions in other industries. In the development of uniform systems it is essential that they conform with sound accounting principles otherwise the consequences may be no better than existing conditions. Uniform systems should clearly define the following:—(1) The relationship between cost and financial accounts; (2) items of expenses to be included in and excluded from costs; (3) what is meant by direct wages, direct materials and other direct expenses; (4) the departments for which costs are to be prepared and how the departmentalisation of expenses is to be done; (5) the method for ascertaining and applying the cost of faulty work; and (6) how costs are charged to orders.

	Per ton £ s. d.
Cost of metal melted	7 0 0
Melting loss 5 per cent. of £7	0 7 0
Cost of melting	1 0 0
Cost of melting and melting loss per ton of metal melted	1 7 0

Considerable attention has been directed to the difficulties associated with uniform costing because how these have been determined and tackled forms a large part of the history of the subject. In the realms where these difficulties have been encountered and successfully overcome are to be found the evidences of positive accomplishment. If the experience of dealing with these difficulties was on record it would be found that these have been liquidated principally by patient and painstaking effort. Further, if there was available a record of the transactions associated with the uniform systems in current use it would be found that amongst a group of collaborators there has been one person upon whom has fallen the principal responsibility for reconciling diverse views and inspiring a spirit of compromise. Those who aspire to pioneer in their own industry would be wise to recognise the difficulties to which reference has been made also to anticipate obstruction, disappointment and some initial failures as preliminaries to the success they desire to achieve. Of course, if such caution is exercised beforehand their actual experience may prove to be more favourable than they anticipated.

The A.F.A. and the Application of Uniform Costs

The use of a uniform system does not mean a static condition. With the development of progressive ideas there ought to be readiness to modify the system by mutual consent otherwise the methods of an entire industry may be backward and such a thought is untenable. Some systems in current use are the effect of principles originally conceived a quarter of a century or more ago which have been progressively improved as the result of the intense thought devoted to them.

Outstanding examples are the systems which have been evolved under the auspices of the American Foundrymen's Association: these comprise separate systems for grey iron, malleable steel and non-ferrous castings. In the preface to one of their publications issued in 1941 there is given an outline of the developments they have sponsored since the matter first received consideration at their convention in 1896. Following the discussion at this convention a cost committee was formed which presented its first recommendation of a uniform system at their convention in 1907. From that time onwards almost every annual convention has had Papers or committee reports devoted to the fostering of uniform cost systems. In 1914, a committee was appointed to compile a report that would present a cost system which would be simple yet sufficiently comprehensive for application in almost every foundry. This committee reported at the 1915 convention and a decision was taken to engage the services of a cost consultant whose system became available to foundries contributing to a special fund. Out of this fund payments were made to the cost consultant for services rendered to the individual foundries which contributed.

In 1919, this particular system was given to the general membership of the A.F.A. as a service to its members. It was realised that this system was not

Metal poured per cent. of metal melted.	Saleable castings. Per cent.		Cost per ton of saleable castings.	Extra per ton compared with average yield of 80 per cent.
			£ s. d.	£ s. d.
95 divided	by 40 equals	2.375 × £1 7s.	3 4 2	1 12 1
95 ,,	50 ,,	1.9 × £1 7s...	2 11 4	0 19 3
95 ,,	60 ,,	1.583 × £1 7s...	2 2 9	0 10 8
95 ,,	70 ,,	1.357 × £1 7s...	1 16 8	0 4 7
95 ,,	80 ,,	1.188 × £1 7s...	1 12 1	—

FIG. 2.—SHOWING DIFFERENCES IN THE COST OF METAL IN SALEABLE CASTINGS FOR DIFFERENT YIELDS.

perfect, especially for the smaller foundries, and efforts were continued to evolve something which would be better adapted for this purpose. At the 1922 convention there was presented an outline of a simple system. In later years it was conceived that no one system would be suitable for all types of foundries, and developments began on separate systems for steel, malleable and grey iron foundries.

In 1930, 1932 and 1933 the subject of uniform costing methods was very prominent in the deliberations at the annual convention. In 1935 it was decided that the immediate future activity should be that of comparing the cost classifications of the four major foundry branches, namely steel, malleable, cast iron and non-ferrous, showing in simple form the basic fundamentals of the four branches and the basic similarities between them. In 1941 various publications of simplified schemes were issued for the purpose of assisting industry under war conditions, and the personnel of a committee was given for the purpose of promoting further progress. All of this is given to indicate how colossal has been the effort of the A.F.A. over a period of nearly half a century, and they are maintaining the necessary machinery for further progressive effort.

In a Paper given before their annual convention in 1937 on the subject of "Methods in the Malleable Iron Industry," it was stated that more than 75 per cent. of the total number of producers in this industry were using the uniform scheme produced by their trade association. This indicates that as a result of the vast effort which has been applied there is evidence that there is a wide recognition that it is the one best system current at any particular time.

British Attainments

In Great Britain attention given to cost systems has been within a limited sphere. In contrast the American practice has evolved complete systems of estimating, costing and book-keeping for the recording of all financial transactions. The American systems are supported with specific forms and descriptions of routine procedure for the wages office, cost office and accounts departments, and thus provide a model accounting system which could be applied in its entirety by a company starting a new business. The results obtained in America have been achieved by the employment permanently of cost consultants by the various trade associations, where work has had to have the approval of the cost committees. There are associations in Great Britain which have worked similarly by having a cost expert full time on their staff or employing part time a cost consultant in practice.

There are indications of the development of thought concerning uniform costing in the foundry industry in Great Britain. In 1943 the General Steel Castings Association issued an outline consisting of three typewritten pages with the title "General Principles Adopted by the Uniform Cost Committee of the General Steel Castings' Association in Formulating a Uniform Costing System for Steel Castings." Within this small compass only the merest outline of principles is given.

Under the title of "Memorandum on Systems of Cost Analysis Approved by the British Ironfounders' Association for the Light-castings Industry," a document has been issued in which the opening paragraph states: "The primary object of the system of cost analysis outlined hereafter is to ensure uniformity in the basis of the construction of costs rather than necessarily involving a rigid system of cost records."

Illustration "A."

Cost per cwt. of saleable castings.	With cores.	Without cores.
Green sand		
Dry sand		
Loam		

Illustration "B."

Plain means without cores.
Medium means with plain cores.
Intricate means with difficult cores.

Weight of castings.		Costs per cwt. of saleable castings.		
From	Up to	Plain.	Medium.	Intricate.
Under 1 lb.	1 lb.			
1 lb.	2 lbs.			
2 lbs.	4 lbs.			
4 lbs.	7 lbs.			
7 lbs.	14 lbs.			
14 lbs.	21 lbs.			
21 lbs.	28 lbs.			
28 lbs.	42 lbs.			
42 lbs.	56 lbs.			
56 lbs.	70 lbs.			
70 lbs.	84 lbs.			
84 lbs.	98 lbs.			
98 lbs.	112 lbs.			

and so on as required.

FIG. 3.—FORMS NECESSARY FOR GROUP COSTING.

This document also consists of three typewritten pages only, but it is supported with three simple forms, one for the purpose of analysing departmental costs, the second for analysing melting costs, the third for preparing the cost of a job. These forms help to illustrate the scheme envisaged, but such a brief statement of principles cannot be expected to provide the guidance necessary for practical purposes.

That the authors were conscious of the practical limitations of their documents is revealed by the following extract: "The foregoing is a broad outline

Uniform Cost Systems

of the general principles, but it will be appreciated that the application of these principles must of necessity vary considerably in the individual foundries, according to their size and the staff available for the costing department. It is recommended, of course, that in conjunction with these main principles there should be in operation a proper system of primary records, such as daily cupola sheets, time sheets, and also a stores control system, not only for the more expensive fittings required for baths and ranges, but also for the charging out of the bulk materials.

Pattern number.	Weight of each casting. lbs.	Per cent. scrapped.	Cost comparisons per cwt., good castings.		Reliable cost prepared in detail for each job.	
			System W.	System X.	System Y.	System Z.
			£ s. d.	£ s. d.	£ s. d.	£ s. d.
101..	90	3.0	1 5 0	0 19 5	0 17 3	1 3 10
102..	86	4.2	1 5 0	0 16 6	0 17 0	1 0 5
103..	105	1.3	1 5 0	0 17 7	0 15 11	1 5 9
104..	160	4.0	1 5 0	1 2 6	1 2 3	1 4 9
105..	340	6.3	1 5 0	0 16 2	0 15 1	0 17 0
106..	548	18.4	1 5 0	0 15 10	0 15 6	0 19 5
107..	103	—	1 5 0	0 16 8	0 16 7	1 0 11
108..	134	4.1	1 5 0	0 14 7	0 13 11	0 17 6
109..	966	11.1	1 5 0	2 15 2	2 19 0	2 10 1
110..	75	—	1 5 0	0 14 7	0 13 4	0 13 11
111..	28	3.2	1 5 0	1 7 0	1 7 6	1 8 2
112..	47	1.6	1 5 0	1 6 9	1 7 0	1 3 4
113..	150	—	1 5 0	1 1 10	0 19 6	1 0 5

System W.—Total operating cost is divided by the weight of saleable castings to obtain an average price per cwt.

System X.—Each job is costed separately, but one overhead rate applied for all departments as a percentage of direct labour. Cost of dressing obtained for each order.

System Y.—As X, except cost of dressing is applied to each order as a percentage of the direct labour for moulding.

System Z.—Each job is costed separately on the form illustrated herewith, which is completed in detail and produces reliable costs.

Individual Job Cost.

Basis used is system Z.

			Lbs.
100 castings—			
Pattern AYZ, Weight	Mould (pour)		1,560
	Gates and runners ..		500
	Scrap castings—		
	From foundry ..	50	
	From customers..	10	
		—	60
	Good castings		1,000
Melting—			Pence
Metal at spout, 1,560 lbs. at £8 7s. per ton		1,396	
Less Gates, runners and scrap, 560 lbs. at scrap price of		420	
£7 per ton		—	976
Coremaking—			
Material			74
Labour .. 5 hours at 2s. 3d.			135
Overheads .. 5 hours at 6s. 3d.			375
Moulding—			
Labour .. 10 hours at 2s. 6d.			300
Overheads .. 10 hours at 7s. 3d.			870
Dressing—			
Barrelling .. 1,060 lbs. at 15s. per ton ..			85
Fettling .. Labour, 2 hours at 2s.			48
Overheads .. 2 hours at 3s. 6d.			84
Other Costs—			
Material for plate mounting			100
Labour .. 2½ hours at 3s.			90
Overheads .. 2½ hours at 3s. 3d.			98
Works costs			3,235
Selling and distribution, 10 per cent. of works cost			324
Outwards carriage, 1,010 lbs. at 5s. per ton ..			27
Total cost			3,586

1,000 lbs. equals per cwt., 402 pence, or £1 13s. 6d.

FIG. 4.—ILLUSTRATIONS OF COSTS OBTAINED BY DIFFERENT COSTING METHODS FOR THE SAME ORDER.

Opinions vary in the industry as to the practicability of these more detailed controls, but here again it is a question of the conditions in each foundry."

If an effort was made to apply the contents of either of these two documents it would have to be said that the effect was an application of principles, whereas in the case of the methods evolved by the American Foundrymen's Association, they are in practice the scheme of this Association. The contrast is between principles and a definite practical scheme. In one case principles are outlined which can be interpreted in many different ways, whereas the American schemes are intended for one interpretation. These two documents are, however, an expression of the recognition of the need for uniform methods in the foundry industry, and maybe, they can be accepted as an augury of things to come.

The Work of the Institute

At the 34th annual conference of the Institute of British Foundrymen a report was presented entitled "Recommendations Concerning the Establishment of Costs in a Grey-iron Foundry," the work of the Costing Sub-committee of the Technical Committee. This consisted of a booklet of 30 pages, and seems to have for its purpose the educating of foundrymen in the need for costing. This consisted of a description of the principles of costing, and is not of a character to promote uniformity. Nearly five years expired from the initiation to the completion of this work, which obviously was the effect of much devoted thought.

Earlier in this Paper reference was made to what uniform systems would have to define clearly. The work of the foundry associations mentioned is not likely to lead to uniformity until more descriptive literature is provided, with illustrations of a full costing scheme and the make up of a cost for a job. It will be necessary to illustrate the source of all information and how it is derived.

The scheme which is probably being most widely used in this country is that of the British Master Printers' Federation. The first edition was published in 1913, and soon afterwards was being introduced by 500 firms. Revisions have been made progressively, and the tenth edition of their scheme was issued in 1940. It is claimed to be in use by the majority of the members of the Federation, and is probably the most advanced expression of uniform methods in practice in this country. The scheme is described in a book of 84 pages with an appendix of forms designed for the working of the system.

Another prominent system is expressed in what is probably the most comprehensive work on uniform costing in this country. It is the uniform cost system of the National Federation of Iron and Steel Manufacturers, which consists of 250 pages with an appendix of forms. This can be examined with much interest, due to the means employed for describing a system in considerable detail. It is also a good reference work to be consulted by the industry. The application of the system is from blast furnaces to the rolling of the finished product. It is considered that the application of this scheme, within the industry for which it was intended, has not been as wide as the work justifies.

Apart from these previously mentioned, other schemes which have been published by or in conjunction with organisations representative of complete industries are:—(1) The British Electrical and Allied Manufacturers' Association; (2) the British Pottery Manufacturers' Federation; (3) the Internal Combustion Engine Manufacturers' Association; (4) the Institution of British Launderers; (5) the National Federation of Hosiery Manufacturers' Association; (6) the Nut and Bolt Association of Great Britain; (7) the Sugar and Confectionery Manufacturers; (8) the Wholesale Clothing Manufacturers' Federation of Great Britain; (9) the British Tin Box Manufacturers' Association; (10) the British Paper Box Manufacturers' Association; (11) the United Kingdom Paper Bag Association; (12) the National Association of Master Bakers, Confectioners and Caterers of Great Britain and Ireland, and (13) the National Association of Paint, Colour and Varnish Manufacturers of the United Kingdom.

Thus it is apparent interest is not only widespread but is gradually being made effective in the evolution of uniform schemes. Some of these schemes have been in existence for many years, but in some instances they have been treated as example schemes and have not been mutually accepted for a common application. It seems that it will be necessary for this subject to be taken up by trade literature and by forum or convention discussion to keep it alive and of current interest. The more effective application of schemes in existence may come with the closer collaboration in industry which can be expected in the future.

BOOK REVIEW

The Transactions of the Manchester Association of Engineers. Session 1943-44. Edited by J. Bolton, assistant secretary.

Spread over the years, the Transactions of the Manchester Association of Engineers show a remarkable catholicity of subject matter. At one time, the study of tool steels was a major activity, whilst at other periods machine tools and workshop organisation have been prominent. A year or two ago, the Association showed much interest in modern foundry practice. The session covered by this volume has included two Papers on mechanical handling, one each on glass making, water filtration, maintenance of lifting tackle, steel pipes and X-ray crystal analysis. This wide range of subjects illustrates quite well the diversity of subjects embraced by the term "engineering." Fortunately, much information disseminated by the specialist engineer is so very often directly helpful to those in other branches, and in this connection most of our readers would derive real benefit from studying Mr. W. Duckworth's Paper on the "Inspection and Maintenance of Lifting Machines and Tackle."

V. C. F.

NEW CATALOGUES

Dilatometer.—The Harry W. Dietert Company, of 9330, Roselawn, Detroit, 4, U.S.A., have issued a 4-page leaflet to describe and illustrate a dilatometer they have designed for ascertaining the physical properties of sand at elevated temperatures. Included in the apparatus is an electric furnace capable of attaining 1,650 deg. C. Sand is rammed under standard conditions into a quartz tube, placed on the end of the plunger, and rapidly pushed upwards into the furnace, controlled within narrow limits to temperatures comparable with those encountered when the metal is introduced into the mould. This test can be designed to the spalling range, but this is by no means the sole purpose of the apparatus. By the use of accessories, it is possible to measure the hot permeability, hot gas pressure, and hot collapsibility of sand mixtures, in addition, of course, to the fundamental determination of expansion. We look forward to seeing one of the machines installed in a British foundry laboratory.

Crucible Furnace.—A three-page folder received from John Hill & Sons (Wolverhampton), Limited, Albion Street, Horseley Field, Wolverhampton, describes and illustrates the "Jonil" coke-fired, balanced, forced-draft, crucible furnace. The features of this furnace are its rapidity in melting—a matter of 20 min. for an 80-lb. pot of metal after the first heat—low fuel consumption, claimed to be 12 to 14 lbs. of coke for the second and subsequent heat, plus the electricity required to operate a ½-h.p. motor used for driving the fan—about a farthing per cast.

The life of the preheater is said to be of the order of 2,000 heats, whilst that of the body lining, a matter of 800 to 900 heats. Ash removal can be effected very rapidly. From the illustration, which could usefully be supplemented by a cross-sectional line drawing, the furnace has every appearance of being soundly and robustly constructed.

SCOTTISH FOUNDRY TRADE PROSPECTS

FULL EMPLOYMENT FOR TEN YEARS

The ironfounding industries in Scotland, which provide a livelihood for more than 100,000 workers and dependants in Stirlingshire, Lanarkshire and Glasgow, will be fully occupied for the next ten years. All the men who were directed into war work will soon return to the foundries to assist in the production of grates, baths, rhone water pipes and other fittings for houses. A leader of the industry told our Glasgow correspondent that more than 2,000,000 grates will be needed for Scottish houses, and that most of these, including gas and electric fires, can be made locally.

Scotland will also require 500,000 baths, and one firm in Lanarkshire is arranging to produce 1,000 a week. Barrhead and other centres will also benefit by the demand for improved bathroom amenities in all types of housing. The Barrhead and similar works should also be busy for a decade. Big contracts are being discussed for the foundry trades, which will also be expected to contribute to London's requirements for temporary housing.

Falkirk, which is one of the main centres of ironfounding, should have no unemployment for many years. The foundry trades will share in the orders for Portal and other prefabricated houses. The largest aluminium foundry in Scotland, if not in Europe, which was equipped for the aircraft industry, will be changed over to the manufacture of household products. This will employ more than 2,000 men making varied types of aluminium articles which formerly were a Midlands monopoly. The managing director of one firm stated there would be a job for every foundryman returning from the Forces or from war work at union wages and conditions until 1955. Even then there still will be more to do than the industry can cope with.

NEW TRADE MARKS

The following applications to register trade marks appear in the "Trade Marks Journal":—

"POLFORD"—Mixing, moulding, drying, and pattern cutting machines. HEATON FOUNDRY COMPANY, LIMITED, Heaton Junction, Newcastle-upon-Tyne, 6.

"WALTERISED"—Metal parts of land vehicles, aircraft, and watercraft. WALTERISATION COMPANY, LIMITED, Waddon Marsh Way, Purley Way, Croydon.

"ENSECOTE"—Tanks, pipes, tubes and containers of common metal or of common metal alloys. NEWTON, CHAMBERS & COMPANY, LIMITED, Thorncliffe, Sheffield.

"CANNON"—Gas-burning, steam-heated, electric, or solid-fuel burning installations and apparatus for lighting, heating, steam generating, cooking, etc. CANNON IRON FOUNDRIES, LIMITED, Deepfields, Bilston, Staffs.

Excluding locomotive and electric traction, latest figures issued by the main line railways and London Transport show that they are at present effecting annual economies in the use of coal to the extent of about 140,000 tons.

An organisation, presided over by the Rt. Hon. R. A. Butler, Minister of Education, and known as the Inter-Allied Book Centre, is appealing to our readers for technical literature of all types in order to re-stock those world renowned libraries in allied countries which have been destroyed through war conditions. The address of the Centre is 3-5, Salisbury Square, London, E.C.4.

The "Nickel Bulletin" for November contains abstracts dealing with hardness testing, influence of nickel and iron on aluminium base alloys, surface fatigue of plastic materials, wear resistant properties of nickel cast iron, thermal expansion and transformation-temperatures of ferrous materials, performance of bimetals at 800 deg. F., and the reclamation of automobile engine valves. Copies may be obtained, free of charge, from the Mond Nickel Company, Limited, Grosvenor House, Park Lane, London, W.1.

THE MODERN PIG

IF YOU WANT...
clean iron, free from sand, free from sows ...uniform analysis... convenient size...easy handling... specify
STANTON MACHINE CAST PIG IRON

SPECIFICATION

WEIGHT	80-90 lbs.
Length	22 inches
Width	8½ inches
Thickness	3¾ inches

(at notch 2½ inches).

Made in our well-known

STANTON, HOLWELL & RIXONS BRANDS

THE STANTON IRONWORKS COMPANY LIMITED NEAR NOTTINGHAM

EXPORTS TO TURKEY

APPLICATIONS FOR LICENCES

Exporters are informed by the Board of Trade that applications for licences to export goods to Turkey included in the following list can only be considered if recommended by the British American Co-ordinating Committee (B.A.C.C.). Exporters should, therefore, advise their Turkish consignees to submit their orders for such goods through the Turkish Bureau Centrale des Commandes for examination by the B.A.C.C.

When an order is so recommended by the B.A.C.C. the United Kingdom exporter, and the Turkish importer, will be advised. The United Kingdom Commercial Corporation, Limited, in London will send the exporter a slip containing details of the recommendation. This slip must accompany the application for an export licence.

Where exporters are in doubt whether goods ordered from them fall within the categories specified in the list, they should lodge an export licence application, and they will then be informed whether a B.A.C.C. recommendation is required. The recommendation of the B.A.C.C. does not necessarily ensure the automatic issue of an export licence, as supply or other important considerations may preclude export from this country. Similarly, goods which do not appear on the list below will not necessarily be available for export freely to Turkey.

Notice of B.A.C.C. recommendations will not normally be required for *bona-fide* trade samples or individual consignments totalling £5 or less in value.

Following is the list:—

Non-ferrous metal ores and concentrates; non-ferrous metals and semi-manufactures thereof (including bolts, nuts, etc., nails, rivets, washers, wire netting, mesh, cloth and gauze); valves, taps and cocks of non-ferrous metal.

Iron and steel and semi-manufactures thereof (including bolts, nuts, etc., nails, rivets, washers, wire netting, mesh, cloth and gauze); ferro-alloys; plated ware; hand and bench tools.

Insulated electric wire and cable.

Agricultural machinery and implements; machinery and plant (not including parts unless elsewhere specified); central-heating plant; ball and roller bearings and parts; machine tools and parts and accessories; welding electrodes.

Mining machinery parts; paper-making machinery parts; railway track material of iron and steel; road and rail vehicles (including bicycles) and parts and accessories); fire-fighting equipment; gauges and measuring instruments of precision.

Electrical machinery and apparatus and plant (not including parts unless elsewhere specified).

Explosives and fuses; industrial diamonds.

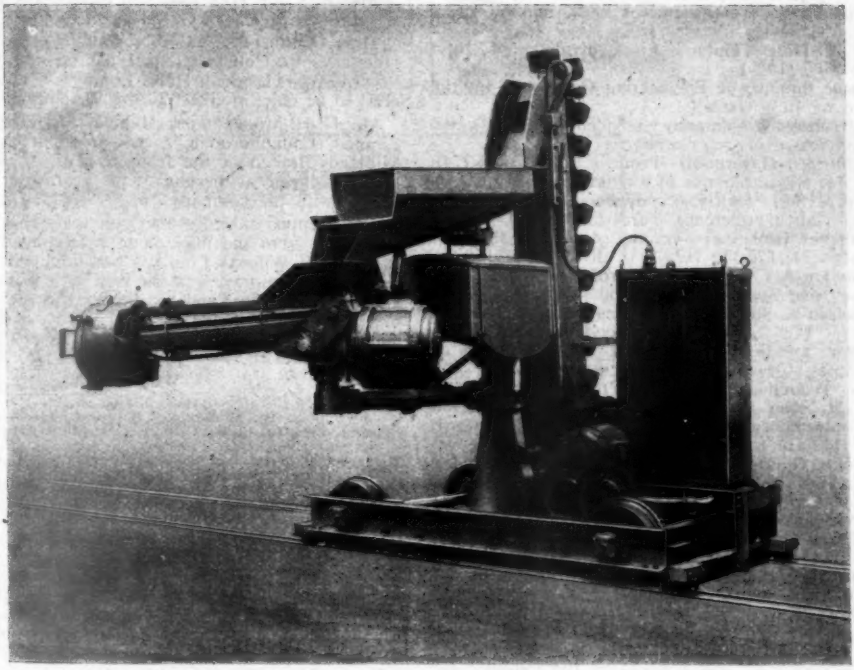
MR. COLIN SHAW, chief engineer of Firth-Vickers Stainless Steels, Limited, Sheffield, died recently, aged 49.

HIGH-COST STEEL PRODUCERS

The twelfth report of the House of Commons Select Committee on National Expenditure for the Session 1943-44 contains replies from the Departments to recommendations in earlier reports. The Treasury and the Departments purchasing or controlling war stores deal particularly with references by the Select Committee to price-fixing in the iron and steel industry. They remark that two points of criticism appear to emerge from the Select Committee's comments, *viz.*: (i) that the iron and steel industry should have been subsidised throughout in respect of the excess cost of imports from the United States, and (ii) that the system of standard prices has an inflationary effect. It is stated in reply that, as regards (i), the position criticised by the Committee obtained only up to January, 1941, since when the stabilisation policy has been in operation, and that in the period to that date a substantial portion of the output was going to private users. As regards (ii), it is true that the necessities of war require the maintenance of high-cost producers and that, as a consequence, higher costs must be paid for their product. One of two things must then happen if a system of standard prices, which the Committee themselves approve, is to operate. Either that standard price must be such as will give the high-cost producer his costs plus a sufficient profit and therefore allow the low-cost producer an undue provisional profit which must then be raked back in the form of a rebate; or, where possible, the standard price can be a weighted average. The latter would be the lower of the two prices, but this can only be done where pooling arrangements are either in voluntary existence within a well organised industry or can be imposed and managed by the Supply Department itself.

The Treasury feel it important to emphasise that the subsidy, if such it be, is not granted to the iron and steel industry, but to the consumers of its products, among whom the Government, directly and indirectly, is predominant. It is also explained that the figure of £9 million quoted by the Committee is the result of debiting the Central Fund within the national cost of Lease-Lend imports. If that debit were reduced to the figure at which such imports were passed on to the consumer the deficit would be replaced by a surplus.

THE ACTIVITIES of the machinery department of J. Gerber & Company, Limited, have been taken over by G.P.U., Limited, which also controls the Electroplant Company, established in 1912. The company will in future trade in the name of the Electroplant Company, with offices and works at the Palace of Engineering, Wembley, Middlesex, formerly occupied by Gerber's machinery department. The new concern, which has already assumed all obligations, will be under the management of Mr. F. L. Kessel, who was previousy in charge of Gerber's machinery department, and the following have been appointed directors:—Mr. H. S. Lewis, Mr. G. L. R. Jones, and Mr. A. G. A. Rainey.



Express Ramming in the Jobbing Foundry

Mounted on a power driven truck, this SANDSLINGER moves to and fro on the track under push button control by the operator. It is fed by hand or conveyor from floor level and rams moulds or cores, large or small, within the compass of its ramming arm (up to 15 ft. radius).

This mobile unit offers the jobbing founder, without complications, the unique facility of express ramming on an infinitely variable range of box sizes.

FOUNDRY PLANT & MACHINERY LTD. 113 W. REGENT ST., GLASGOW.

COMPANY RESULTS

(Figures for previous year in brackets.)

Broom & Wade—Dividend of 15%, making 22½% (same).

Hale & Hale (Tipton)—Final dividend of 10%, making 15% (10%).

Whessoe Foundry & Engineering Company—Interim dividend of 10% (same).

John Holroyd & Company—Dividend of 20% (same) on the increased ordinary capital.

Chadburns (Liverpool)—Profit, £7,421 (£6,274); dividend of 6% and bonus of 4% (same).

Ewart & Son—Half-year's dividend arrears on the 16% cumulative preference shares to June 30, 1941.

Gascoignes (Reading)—Trading profit for the year to October 31, £20,350 (£24,793); dividend of 15%.

C. Lindley & Company—Net profit, £9,356 (£9,421), after tax; final dividend of 15%, making 25% (same).

Thompson & Southwick—Trading profit for year to August 31, £7,089 (£6,675); depreciation, £693 (£648); income-tax and E.P.T., £4,525 (£4,502); dividend of 7½% (same); forward, £2,508 (£1,904).

Jonas Woodhead & Sons—Profit for year to August 31, after taxation and contingencies, £14,738 (£18,890); ordinary dividend of 10% (same); forward, £18,004 (£17,513, after £5,000 to staff pensions).

Shelvoke & Drewry—Profit for the year ended July 31, 1944, £176,894 (£77,674); taxation, £164,500, plus £6,000 to cover estimated liability on profits to date; dividend of 10% (same); forward, £7,141 (£6,997).

Crompton Parkinson—Profit to September 30 last, £432,099 (£431,413); final dividend on the ordinary and "A" ordinary shares of 7½% (same), and a special bonus of 7½% (same), making 22½% (same); forward, £588,256 (£488,657).

George Turton, Platts—Credit balance for the year to July 31, after taxation, £33,938; final dividend of 10%, making 17½%, and a bonus of 10%; special depreciation, £7,500; reserve for contingencies, £5,000; forward, £26,045 (£25,320).

E. G. Brown & Company—Net profit for the year to September 30, 1944, £243,868 (£205,723); income-tax and E.P.T., £220,000 (£182,000); to general reserve, £1,000 (£2,000); final ordinary dividend of 2.4d., making 4.8d., or 20% (same); forward, £16,949 (£16,831).

Ferranti—Trading profit to June 30 last, after provision for taxation, £160,490 (£142,981); depreciation, £43,890 (£51,859)); war damage insurance, £2,678; reserve for deferred repairs, £14,570; net profit, £96,237 (£71,285); preference dividends, less tax, £17,500; to contingency reserve, £60,000 (£35,000); dividend of 6%, tax free, on the ordinary stock, £18,000 (same); forward, £76,471 (£75,734).

Electric Furnace Company—Profit for the year ended March 31, 1944, £79,262 (£54,544); dividends from subsidiary companies, £4,000; interim dividend of 3½% on the cumulative preferred ordinary shares, £2,992 (same); interim dividend of 3½% on the ordinary shares, £2,739 (same); second interim of 4½% on the cumulative preferred shares, £3,848 (same); second interim of 4½% on the ordinary shares, £3,521 (same); E.P.T. and income-tax, £55,000 (£32,000); to general reserve, £10,000 (same); forward, £9,733 (£8,121).

PERSONAL

MR. R. T. DE POIX has been elected a joint managing director of Henry Gardner & Company, Limited.

MR. ARTHUR F. CARGILL, planning officer of the Dumfriesshire County Council, has been appointed by G. & J. Weir, Limited, Holm Foundry, Cathcart, Glasgow, to be chief architect to the Weir organisation.

MR. H. H. MOORE, works director of Herbert Morris, Limited, Loughborough, a past-president of the East Midlands Branch of the Institute of British Foundrymen, is retiring at the end of the year, after 41 years' service with the company.

SIR ARCHIBALD MCKINSTRY, on the occasion of his retirement from the position of managing director of Babcock & Wilcox, Limited, has been presented by the Renfrew employees of the firm with a silver salver, a silver tea service, and an illuminated address. The presentation was made by Mr. W. H. Birks, works manager. Sir Archibald will remain with the firm as deputy chairman.

Wills

WILLIAMS, M. B., of Swansea, mining engineer ...	£17,267
WOODWARD, R. H., of Edgbaston, brassfounder ...	£36,017
BALFOUR, BERTRAM, of Sheffield, a director of Arthur Balfour & Company, Limited	£14,567
MATTHEWS, F. B., of Langholm, director of the South Hetton Coal Company, Limited	£79,413
HODGKIN, S. H., of Reading, chairman of the Pulsometer Engineering Company, Limited ...	£82,755
HUDSON, EDWARD, of Harewood, near Leeds, a director of Robert Hudson, Limited, engineers ...	£120,401

NEWS IN BRIEF

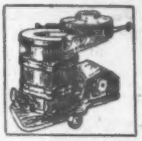
VICTORIA BRASSWORKS (BURNLEY), LIMITED, is being wound up voluntarily. Mr. Herbert Shepherd, 11, Ormerod Road, Burnley, is the liquidator.

FRY'S DIECASTINGS, LIMITED, have addressed an inquiry to the Uttoxeter Urban District Council for a site in the district suitable for the erection of a foundry. Their letter has been referred to the Housing and Town Planning Committee of the Council.

TUBULAR SCAFFOLDING used for the protection of beaches will be disposed of by the War Office, either as scrap or for use in agriculture. It does not conform with British standard specifications. Prospective buyers should apply to the Director of Salvage at the War Office.

THE COMPANIES REGISTRATION OFFICE gives notice that the names of the undermentioned companies have been struck off the register, and such companies are dissolved:—Aston Cross Foundry Company, Limited; Combustion Control, Limited; Manchester Airscrews, Limited; Morris (Black Horse) Machine Tools, Limited; Rallings Engineering Works, Limited.

THE FIRST of the "Harold Wright" lectures, which have been endowed by Dorman, Long & Company, Limited, in recognition of the long and distinguished service of their chief chemist, was delivered by Dr. C. H. Desch, at the Cleveland Technical Institute, Middlesbrough, on December 13. The title of the lecture was "The Past and Future of Steel."



SHALAGO BONDED BLACKING

(IN THREE GRADES)

No Clay, Gum or Other Bond Required. Mix with Clear Water Only.

BONDED No. 3 SHALAGO BLACKING

STANDARD GRADE FOR HIGH CLASS DRY SAND
SMOOTH IN APPLICATION – NO BRUSH MARKS

BONDED SUPER-SHALAGO BLACKING

HEAVIER THAN No. 3 – THIS BLACKING HAS
STRIPPED SOME OF THE HEAVIEST JOBS MADE

BONDED CHILLED-ROLL BLACKING

SPECIALLY BLENDED TO HOLD FIRM ON A METAL
SURFACE – IDEAL FOR ROLLS AND CHILLS

Claywash is variable.
Cumming's Bonded Blacking mixed into clear water makes better Blackwash.

Wm. CUMMING & Co.

LIMITED

GLASGOW
FALKIRK
CHESTERFIELD
DEEPFIELDS
MIDDLESBROUGH

NEW COMPANIES

("Limited" is understood. Figures indicate capital. Names are of directors unless otherwise stated. Information compiled by Jordan & Sons, 116, Chancery Lane, London, W.C.2.)

Charlton Ironworks, 3, Cambridge Street, Sheffield—£2,000. T. Oxley.

Kensal Engineering Company, 1, Budge Row, London, E.C.4—£1,000.

Britorg Engineering Corporation, 112, Gresham House, London, E.C.2—£1,000.

Universal Holloware—£10,000. G. G. G. Carlisle, 5, St. Catherines Hill, Worcester.

A. F. Bayford & Company (Engineers)—£1,000. A. H. D. Fairbarns and E. M. Cattell.

S. B. Skitt & Company, Swallow Street, Stockport—Engineers. £1,000. S. B., J., and E. Skitt.

Palisan Products, 203, Regent Street, London, W.1—Manufacturers of foundry requisites, etc. £1,000.

"Dee-Kay" Engineering Company—£3,000. E. A. Harris, 68, Radnor Road, Twickenham, subscriber.

Collon Engineering Company, 158, Finsbury Pavement House, London, E.C.2—£500. N. T. F. Wootton.

Jeffcock & Davidson, 10, Benson Street, Leeds—Engineers, etc. £2,000. F. Jeffcock and A. Davidson.

Croombs Welding & Engineering Company—£3,000. H. M. Terry, 17, Holborn Viaduct, London, E.C.1.

Agricultural Machinery, Edgware Road, The Hyde, London, N.W.9—£20,000. E. H. and E. J. M. Jones.

Facer Manufacturing Company—Engineers, etc. £3,000. H. C. and E. Hardyman, M. Ward, and S. Moss.

Pignon & Roberts, 23-24, Easton Street, London, E.C.1—Engineers, etc. £5,000. H. L. Pignon and E. Roberts.

Reader Hand & Company, Upper Brown Street, Leicester—Engineers, etc. £5,000. W. A. Reader and F. Hand.

John S. Homer, 159, Charles Street, West Bromwich—Engineers, etc. £2,000. J. S. Homer and G. Reynolds.

James Rogers Electric Furnaces—£2,000. S. Disborough, 18, Austin Friars, London, E.C., subscriber.

Thiray Engineering Company, 25, Mornington Place, London, N.W.1—£1,000. E. W. Wallington and H. D. Bulgin.

C. J. Jefferies, Radnor House, 93-97, Regent Street, London, W.1—Engineers, etc. £2,000. C. J. Jefferies and F. J. Sandall.

Davies & Cann, Freemans Wharf, Cremyll Street, Plymouth—Scrap metal merchants, etc. £5,000. W. H. Davies and H. Cann.

Dimond, Brown & Company, 8a, Courtney Street, London, S.E.11—Engineers, etc. £1,000. D. W. Dimond and E. Brown.

Eastern Hardware Company, 63, London Road North, Lowestoft—Engineers, hardwaremen, etc. S. O. Bird and J. S. Conolly.

Links Engineers, Norfolk House, Upper Bristol Road, Bristol—£1,000. T. Moll, F. H. J. Bull, C. Fry, G. E. Titley, and W. E. Ballard.

Crouch Engineering Company (Burnham-on-Crouch)—£1,000. R. J. S. Tucker, 13, Western Road, Burnham-on-Crouch, subscriber.

Frank Webb, Convent Street, Lower Parliament Street, Nottingham—Engineers. £2,000. F. and E. J. Webb and D. A. Beardsley.

H. Davies & Company (London), Phœnix Works, 7, Wimborne Street, London, N.1—Engineers, etc. £1,600. F. and M. B. Hood.

Mechanical Patents, 7, Warwick Court, Grays Inn, London, W.C.1—Founders, engineers, etc. £500. H. E. Moore and E. Appleby.

Arthur Howell, Newton Chambers, Cannon Street, Birmingham—Zinc workers, etc. £5,000. J. A. Bebbington and J. F. Williams.

Doran & Company (Bridlington), Langdales Wharf, Bridlington, Yorks—Engineers. £8,000. J. P. A. L. Doran and G. W. Hainsworth.

Huddersfield Transmission—Ironfounders, engineers, etc. £2,000. G. Laycock, 31, Lynndale Avenue, Birkby, Huddersfield, subscriber.

W. D. Cooke & Company, 244, Blurton Road, Fenton, Stoke-on-Trent—Engineers, etc. £1,000. W. D. Cooke and M. E. Dean.

Gauge Improvements—Engineers, etc. £100. A. H. F. Bowness, Courtenay Hotel, Warwick New Road, Leamington Spa, subscriber.

Harcliffe Engineering Company, Harcliffe Works, Cannock Road, The Scotlands, Wolverhampton—£3,000. H. S. Poole and C. C. Hughes.

Kemet Products—To develop metallurgical and chemical products, etc. £75,000. Sir G. S. Pott, Clifton Hampden, Abingdon, subscriber.

Weldcraft, Progress Way, Croydon—Manufacturers of welding and cutting machines, etc. £5,000. L. J. Hancock, A. V. Marshall, and E. S. Semper.

Westley, Finbow & Company, 23, Cleves Walk, Ilford, Essex—Ironfounders, engineers, etc. H. J. Westley, R. C. Finbow and A. E. Howard.

Refrigeration & Electrical Products (London), 56, Finsbury Pavement, London, E.C.2—£1,000. F. H. Meyers, L. H. Metz, and C. B. H. Fentiman.

R. P. Froggatt, 59, Long Row West, Nottingham—Manufacturers of traction engines, agricultural implements, etc. £12,000. R. P. and G. M. Froggatt.

Telick Company, 110, Colmore Row, Birmingham, 3—Manufacturers of components for the hollowware trade, etc. £500. E. M. Thompson and H. Jones.

Fullhard, Globe Works, Penistone Road, Sheffield, 6—To acquire patents relating to the heat-treatment of metals, etc. £1,000. H. Fuller and H. Warburton.

Morton Peel Engineering & Supply Company, Waterloo Place, Lower Regent Street, London, S.W.1—£5,000. E. Morton Peel, J. F. Stewart, and M. Kon.

Bradley & Burch (Ilford), Imperial Works, Sunnyside Road, Ilford, Essex—Founders, toolmakers, etc. £2,000. G. W. F. and L. I. Richards and D. H. King.

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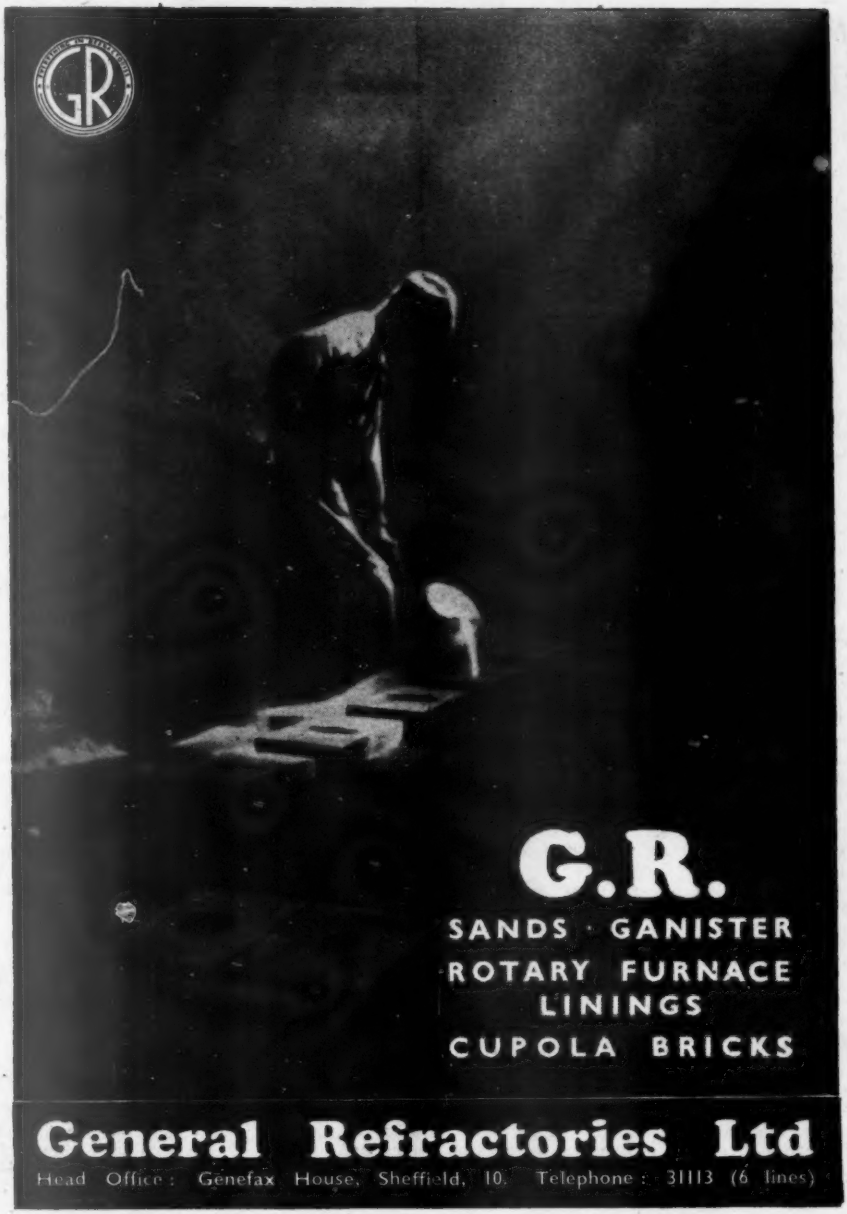
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Raw Material Markets

IRON AND STEEL

Most foundries and iron and steel works resumed operations after the Christmas holiday to-day (Thursday), but some will not restart until Monday. The interruption to production is not likely seriously to impede consumers of low- and medium-phosphorus and refined pig-iron, as there seems to be ample to meet the immediate requirements of the general engineering foundries. These foundries, as well as the jobbing foundries, are seeking additional work, and they are hoping that the Board of Trade will shortly make it possible for them to engage in some civil trade. Some foundrymen, of course, are still fully occupied on the production of special castings for Government contracts, but for some time past there have been many gaps in the industry.

Supplies of hematite remain difficult, and the Control authorities are still reluctant to release deliveries if alternative grades of iron are available. Where other qualities are not suitable, however, hematite is usually released. Ferro-alloys are being despatched without delay, while the scrap iron and steel position has improved considerably in recent weeks.

Light-castings makers appear to be getting ample supplies of high-phosphorus iron, but stocks at the Derbyshire and Northamptonshire furnaces have fallen to a very low level. These consumers are anxious to seek new outlets for their products, but, if they are successful in their quest, they may find that their hands are tied owing to inadequate deliveries of iron. Any further expansion in trade without a corresponding improvement in the output of pig-iron would make things extremely difficult. Considering the amount of labour available, quite a considerable portion of the light-castings trade is well employed on orders for domestic castings, including cookers, ranges, kitchen utensils, builders' castings, etc.

The foundry coke position has not changed to any appreciable extent. Supplies are coming through fairly regularly, although not so freely as consumers would like in many cases. Collieries are being pressed very strongly, not only for supplies of coke for foundry and blast-furnace use, but for other uses which have come into prominence recently. Fortunately, a considerable number of foundries have good stocks on which to rely should the position deteriorate.

Although the re-rollers are not being pulled out of the place to the extent that they were, there is still a steady demand for their products in light sections, small steel bars, strip and specials. The easing-off in specifications which has been apparent in the last few weeks will enable the re-rollers to overtake arrears. They are getting good tonnages of raw material from English and Welsh sources. Billets, blooms, sheet bars, etc., are coming through steadily, and there do not appear to be any complaints on this score. Although the re-rollers of bars find the position easing, this is not so in the case of the sheet makers, who are inundated with work and have commitments well into 1945. The steelworks find ready outlets for defective billets, double sawn crops, and the like, but defective sheet bars and crops are not a good market, and some works find difficulty in keeping their accumulations within reasonable limits.

The market for heavy steel plates and heavy joists and sections remain rather sluggish. The plate mills could undertake considerably more work than is at present forthcoming for early delivery, and there does not appear as yet any prospect of there being any substantial demand for heavy structural materials. Meantime, the steelworks are fairly well covered for business in light and medium sections. There is not the extreme pressure that there was, but even so orders on the books are for appreciable quantities, and will keep the mills busy well into the first period of 1945.

NON-FERROUS METALS

The non-ferrous metal supply situation, generally speaking, is quite sound, except for the fact that tin is reserved for essential purposes only. No real improvement can be envisaged in tin supplies until the Japanese occupation of Malaya, Siam, and the Netherlands East Indies is ended. The U.S.A. is believed to hold substantial stocks of tin in metal and concentrates, and we in this country may also be comfortably situated in this respect.

The zinc position is certainly much easier. Consequently, consumers are now permitted to engage in the production of a number of articles for civilian use which were strictly banned until recently. Many of them, however, are handicapped for the time being by labour shortage and lack of equipment. British commercial representatives, according to officials of the U.S. State Department, are making efforts to interest the American Government in an international zinc agreement between U.S. and British producers.

As in the case of zinc, the shortage of labour and equipment at the consuming works is precluding full use being made of the available supplies of lead, which are quite satisfactory in existing circumstances.

Details have been given of how four Teesside constructional firms co-operated with the Admiralty at the beginning of the war to reopen a disused shipyard at Thornaby-on-Tees. The Admiralty decided that the yard should be reopened and that prefabricated landing craft should be included in its programme. Head, Wrightson & Company, Limited, Teesdale Ironworks, were consulted, and the help of three other firms, the Cargo Fleet Iron Company, Limited, the Whessoe Foundry & Engineering Company, Limited, and the Cleveland Bridge & Engineering Company, Limited, was enlisted. These four firms formed a company with Sir Thomas Guy Wrightson, Bt., as chairman. The new company was intended to assemble the prefabricated parts which each company assembled at its own works. The shipyard was eventually cleared of weeds, etc., and the first ship was launched in May, 1941. Eventually about 1,000 employees were started, and key men who had retired from work were persuaded to return.

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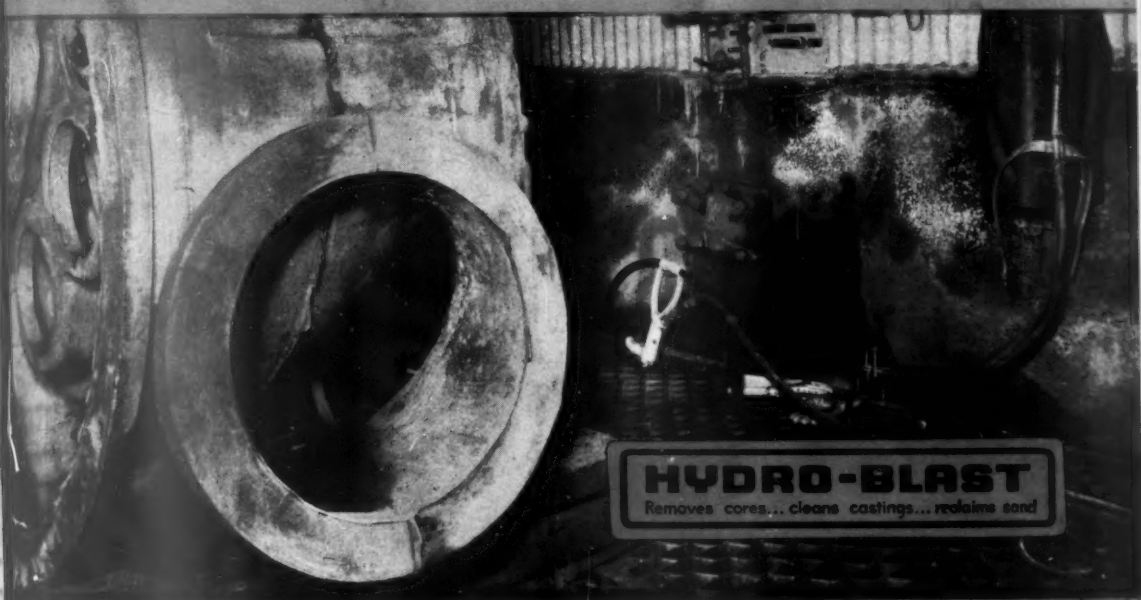

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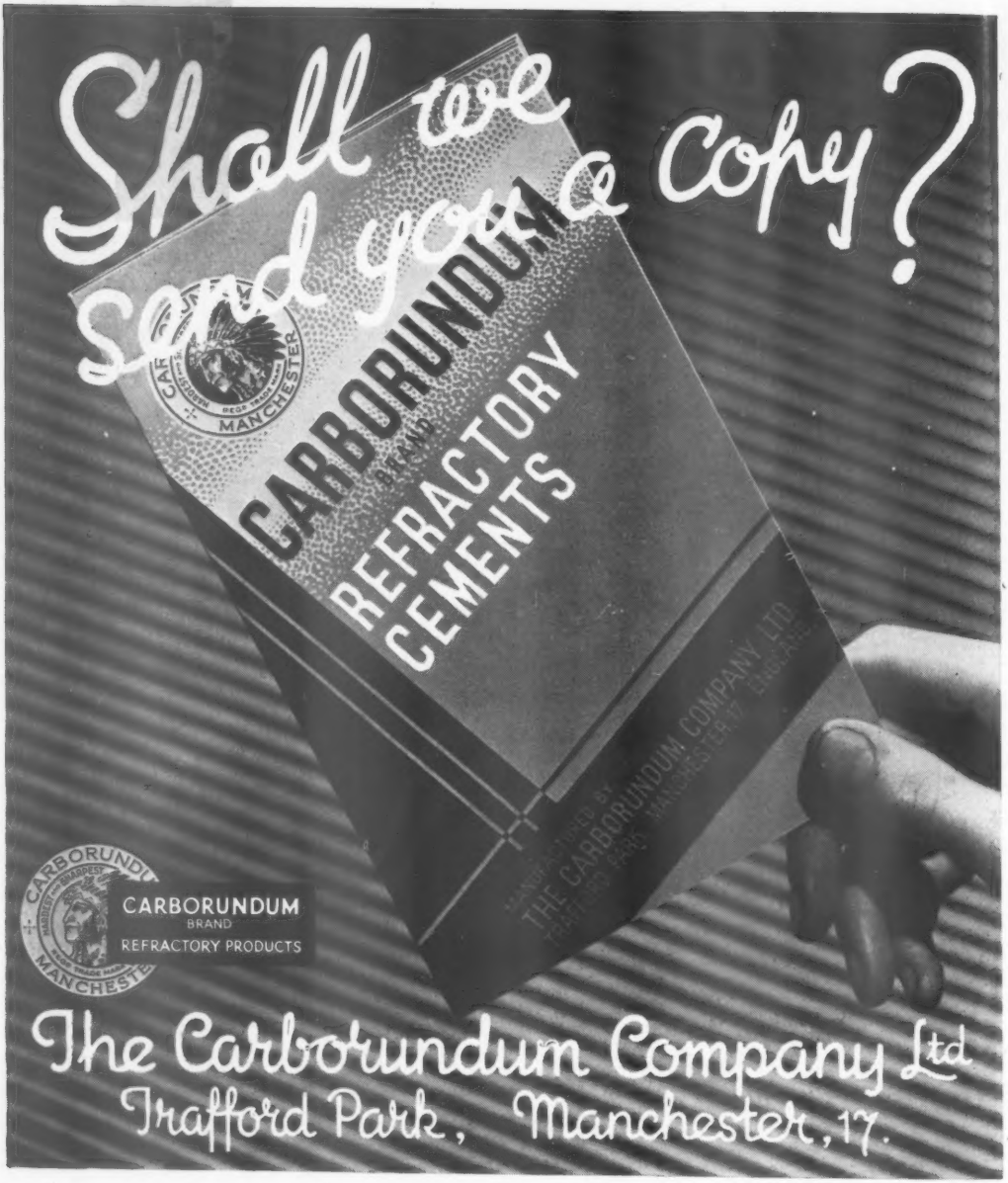
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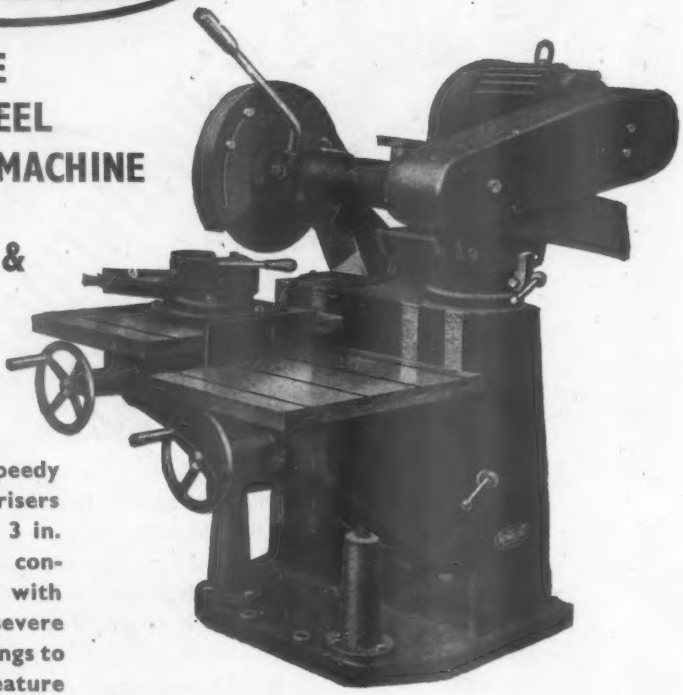

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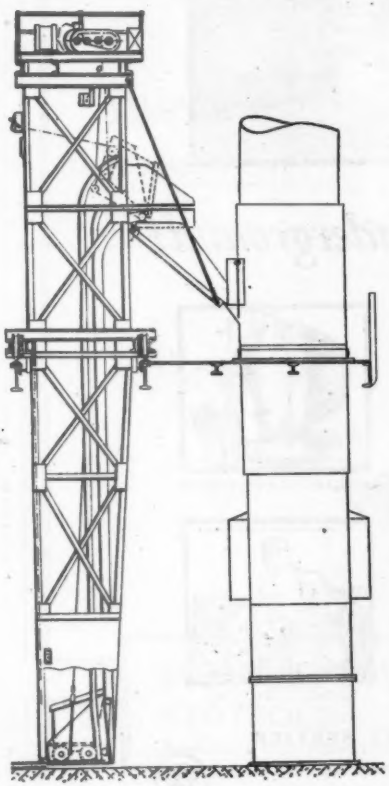

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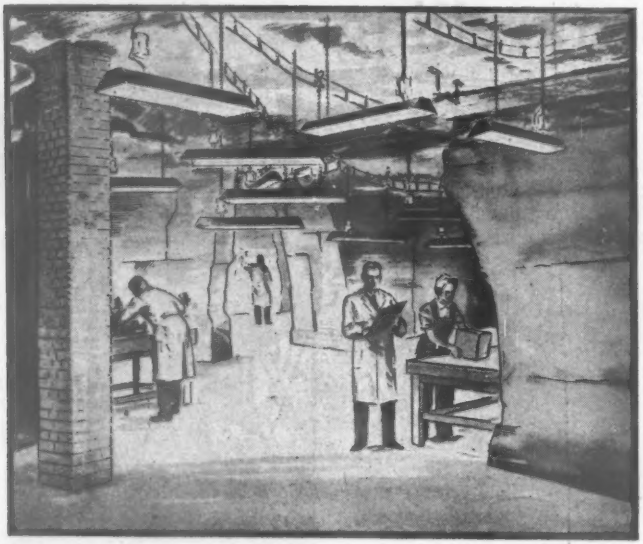

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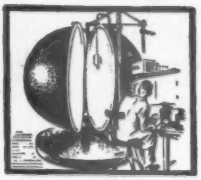

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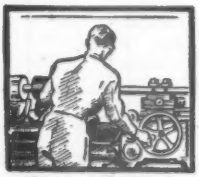

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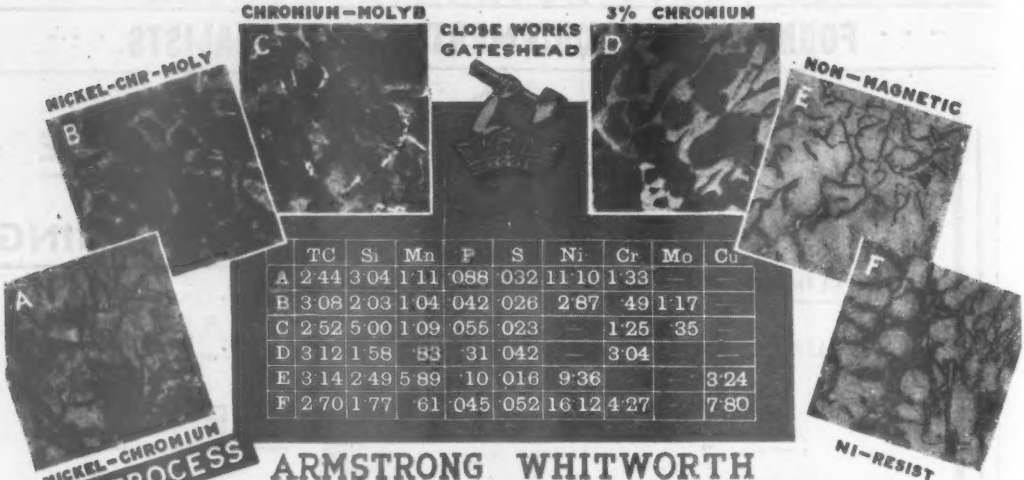

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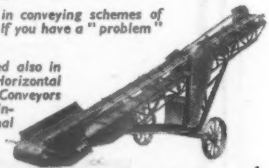

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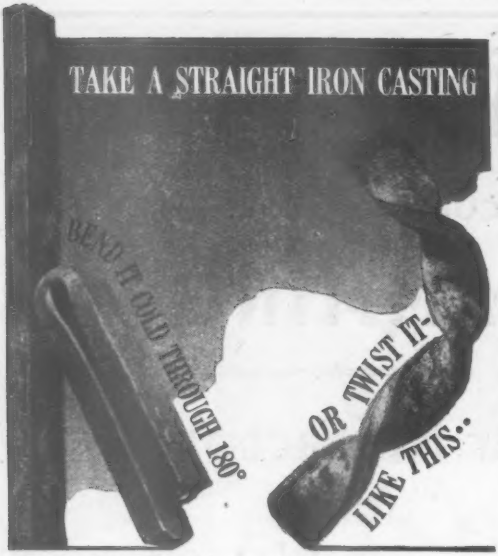

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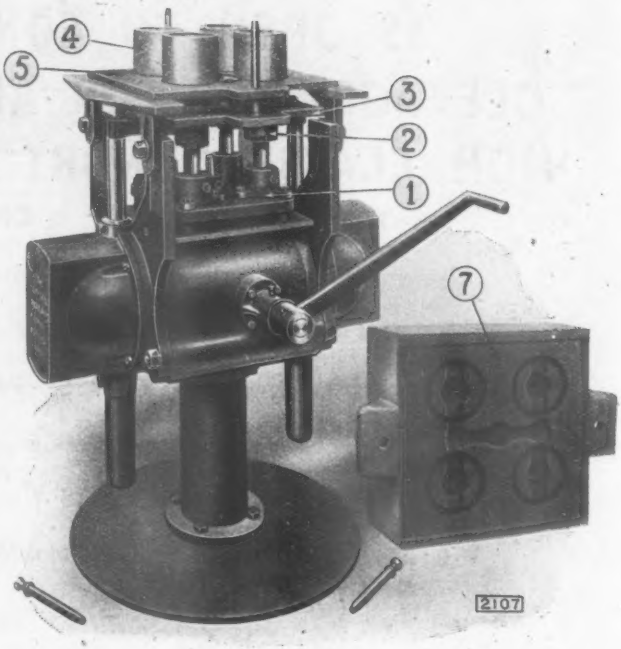

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(*No. 1 foundry 3s. above No. 3. No. 4 forge 1s. below No. 3 for foundries, 3s. below for ironworks.*)

Hematite.—Si up to 3.00 per cent., S & P 0.03 to 0.05 per cent.; Scotland, N.-E.Coast and West Coast of England, 138s. 6d.; Sheffield, 144s.; Birmingham, 150s.; Wales (Welsh iron), 134s. East Coast No. 3 at Birmingham, 149s.

Low-phosphorus Iron.—Over 0.10 to 0.75 per cent. P, 140s. 6d., delivered Birmingham.

Scotch Iron.—No. 3 foundry, 124s. 9d.; No. 1 foundry, 127s. 3d., d/d Grangemouth.

Cylinder and Refined Irons.—North Zone, 174s.; South Zone, 176s. 6d.

Refined Malleable.—North Zone, 184s.; South Zone, 186s. 6d.

Cold Blast.—South Staffs, 227s. 6d.

(NOTE.—*Prices of hematite pig-iron, and of foundry and forge iron with a phosphoric content of not less than 0.75 per cent., are subject to a rebate of 5s. per ton.*)

FERRO-ALLOYS

(*Per ton unless otherwise stated, basis 2-ton lots, d/d Sheffield works.*)

Ferro-silicon (5-ton lots).—25 per cent., £21 5s.; 45 per cent., £25 10s.; 75 per cent., £39 10s. Briquettes, £30 per ton.

Ferro-vanadium.—35/50 per cent., 15s. 6d. per lb. of V.

Ferro-molybdenum.—70/75 per cent., carbon-free, 6s. per lb. of Mo.

Ferro-titanium.—20/25 per cent., carbon-free, 1s. 3½d. lb.

Ferro-tungsten.—80/85 per cent., 9s. 8d. lb.

Tungsten Metal Powder.—98/99 per cent., 9s. 9½d. lb.

Ferro-chrome.—4/8 per cent. C, £46 10s.; max. 2 per cent. C, 1s. 3½d. lb.; max. 1 per cent. C, 1s. 4½d. lb.; max. 0.5 per cent. C, 1s. 6d. lb.

Cobalt.—98/99 per cent., 8s. 9d. lb.

Metallic Chromium.—96/98 per cent., 4s. 9d. lb.

Ferro-manganese.—78/98 per cent., £18 10s.

Metallic Manganese.—94/96 per cent., carb.-free, 1s. 9d. lb.

SEMI-FINISHED STEEL

Re-rolling Billets, Blooms and Slabs.—BASIC: Soft, u.t., 100-ton lots, £12 5s.; tested, up to 0.25 per cent. C, £12 10s.; hard (0.42 to 0.60 per cent. C), £13 17s. 6d.; silico-manganese, £17 5s., free-cutting, £14 10s. SIEMENS MARTIN ACID: Up to 0.25 per cent. C, £15 15s.; case-hardening, £16 12s. 6d.; silico-manganese, £17 5s.

Billets, Blooms and Slabs for Forging and Stamping.—Basic, soft, up to 0.25 per cent. C, £13 17s. 6d.; basic hard, 0.42 to 0.60 per cent. C, £14 10s.; acid, up to 0.25 per cent. C, £16 5s.

Sheet and Tinplate Bars.—£12 2s. 6d., 6-ton lots.

FINISHED STEEL

[*A rebate of 15s. per ton for steel bars, sections, plates, joists and hoops is obtainable in the home trade under certain conditions.*]

Plates and Sections.—Plates, ship (N.-E. Coast), £16 3s., boiler plates (N.-E. Coast), £17 0s. 6d.; chequer plates (N.-E. Coast), £17 13s.; angles, over 4 un. ins., £15 8s.; tees, over 4 un. ins., £16 8s.; joists, 3 in. × 3 in. and up, £15 8s.

Bars, Sheets, etc.—Rounds and squares, 3 in. to 5½ in., £16 18s.; rounds, under 3 in. to ⅜ in. (untested), £17 12s.; flats, over 5 in. wide, £15 13s.; flats, 5 in. wide and under, £17 12s.; rails, heavy, f.o.t., £14 10s. 6d.; hoops, £18 7s.; black sheets, 24 g. (4-ton lots), £22 15s.; galvanised corrugated sheets (4-ton lots), £26 2s. 6d.; galvanised fencing wire, 8 g. plain, £26 17s. 6d.

Tinplates.—I.C. cokes, 20 × 14 per box, 29s. 9d. f.o.t. makers' works, 30s. 9d., f.o.b.; C.W., 20×14, 27s. 9d., f.o.t., 28s. 6d., f.o.b.

NON-FERROUS METALS

Copper.—Electrolytic, £62; high-grade fire-refined, £61 10s.; fire-refined of not less than 99.7 per cent., £61; ditto, 99.2 per cent., £60 10s.; black hot-rolled wire rods, £65 15s.

Tin.—99 to under 99.75 per cent., £300; 99.75 to under 99.9 per cent., £301 10s.; min. 99.9 per cent., £303 10s.

Spelter.—G.O.B. (foreign) (duty paid), £25 15s.; ditto (domestic), £26 10s.; "Prime Western," £26 10s.; refined and electrolytic, £27 5s.; not less than 99.99 per cent., £28 15s.

Lead.—Good soft pig-lead (foreign) (duty paid), £25; ditto (Empire and domestic), £25; English, £26 10s.

Zinc Sheets, etc.—Sheets, 10g. and thicker, ex works, £37 12s. 6d.; rolled zinc (boiler plates), ex works, £35 12s. 6d.; zinc oxide (Red Seal), d/d buyers' premises, £30 10s.

Other Metals.—Aluminium, ingots, £110; antimony, English, 99 per cent., £120; quicksilver, ex warehouse, £68 10s. to £69 15s.; nickel, £190 to £195.

Brass.—Solid-drawn tubes, 14d. per lb.; brazed tubes, 16s.; rods, drawn, 11¾d.; rods, extruded or rolled, 9d.; sheets to 10 w.g., 11½d.; wire, 10½d.; rolled metal, 10½d.; yellow metal rods, 9d.

Copper Tubes, etc.—Solid-drawn tubes, 15½d. per lb.; brazed tubes, 15½d.; wire, 10d.

Phosphor Bronze.—Strip, 14½d. per lb.; sheets to 10 w.g.; 15½d.; wire, 16½d.; rods, 16½d.; tubes, 21½d.; castings, 20d., delivery 3 cwt. free. 10 per cent. phos. cop. £35 above B.S.; 15 per cent. phos. cop. £43 above B.S.; phosphor tin (5 per cent.) £40 above price of English ingots. (C. CLIFFORD & SON, LIMITED.)

Nickel Silver, etc.—Ingots for raising, 10d. to 1s. 4d. per lb.; rolled to 9 in. wide, 1s. 4d. to 1s. 10d.; to 12 in. wide, 1s. 4½d. to 1s. 10½d.; to 15 in. wide, 1s. 4½d. to 1s. 10½d.; to 18 in. wide, 1s. 5d. to 1s. 11d.; to 21 in. wide, 1s. 5½d. to 1s. 11½d.; to 25 in. wide, 1s. 6d. to 2s. Ingots for spoons and forks, 10d. to 1s. 6½d. Ingots rolled to spoon size, 1s. 1d. to 1s. 9½d. Wire, round, to 10g., 1s. 7½d. to 2s. 2½d., with extras according to gauge. Special 5ths quality turning rods in straight lengths, 1s. 6½d. upwards.

NON-FERROUS SCRAP

Controlled Maximum Prices.—Bright untinned copper wire, in crucible form or in hanks, £57 10s.; No. 1 copper wire, £57; No. 2 copper wire, £55 10s.; copper firebox plates, cut up, £57 10s.; clean untinned copper, cut up, £56 10s.; braziery copper, £53 10s.; Q.F. process and shell-case brass, 70/30 quality, free from primers, £49; clean fired 303 S.A. cartridge cases, £47; 70/30 turnings, clean and baled, £43; brass swarf, clean, free from iron and commercially dry, £34 10s.; new brass rod ends, 60/40 quality, £38 10s.; hot stampings and fuse metal, 60/40 quality, £38 10s.; Admiralty gunmetal, 88-10-2, containing not more than ¼ per cent. lead or 3 per cent. zinc, or less than 9½ per cent. tin, £77, all per ton, ex works.

Returned Process Scrap.—(Issued by the N.F.M.C. as the basis of settlement for returned process scrap, week ended Dec. 23, where buyer and seller have not mutually agreed a price; net, per ton, ex-sellers' works, suitably packed):—

BRASS.—S.A.A. webbing, £48 10s.; S.A.A. defective cups and cases, £47 10s.; S.A.A. cut-offs and trimmings, £42 10s.; S.A.A. turnings (loose), £37; S.A.A. turnings (baled), £42 10s.; S.A.A. turnings (masticated), £42; Q.F. webbing, £49; defective Q.F. cups and cases, £49; Q.F. cut-offs, £47 10s.; Q.F. turnings, £38; other 70/30 process and manufacturing scrap, £46 10s.; process and manufacturing scrap containing over 62 per cent. and up to 68 per cent. Cu, £43 10s.; ditto, over 58 per cent. to 62 per cent. Cu, £38 10s.; 85/15 gilding metal webbing, £52 10s.; 85/15 gilding defective cups and envelopes before filling, £50 10s.; cap metal webbing, £54 10s.; 90/10 gilding webbing, £53 10s.; 90/10 gilding defective cups and envelopes before filling, £51 10s.

CUPRO NICKEL.—80/20 cupro-nickel webbing, £75 10s.; 80/20 defective cups and envelopes before filling, £70 10s.

NICKEL SILVER.—Process and manufacturing scrap; 10 per cent. nickel, £50; 15 per cent. nickel, £56; 18 per cent. nickel, £60; 20 per cent. nickel, £63.

COPPER.—Sheet cuttings and webbing, untinned, £54; shell-band plate scrap, £56 10s.; copper turnings, £48.

IRON AND STEEL SCRAP

(*Delivered free to consumers' works. Plus 3¼ per cent. dealers' remuneration. 50 tons and upwards over three months, 2s. 6d. extra.*)

South Wales.—Short heavy steel, not ex. 24-in. lengths, 82s. to 84s. 6d.; heavy machinery cast iron, 87s.; ordinary heavy cast iron, 82s.; cast-iron railway chairs, 87s.; medium cast iron, 78s. 3d.; light cast iron, 73s. 6d.

Middlesbrough.—Short heavy steel, 79s. 9d. to 82s. 3d.; heavy machinery cast iron, 91s. 9d.; ordinary heavy cast iron, 89s. 3d.; cast-iron railway chairs, 89s. 3d.; medium cast iron, 79s. 6d.; light cast iron, 74s. 6d.

Birmingham District.—Short heavy steel, 74s. 9d. to 77s. 3d.; heavy machinery cast iron, 92s. 3d.; ordinary heavy cast iron, 87s. 6d.; cast-iron railway chairs, 87s. 6d.; medium cast iron, 80s. 3d.; light cast iron, 75s. 3d.

Scotland.—Short heavy steel, 79s. 6d. to 82s.; heavy machinery cast iron, 94s. 3d.; ordinary heavy cast iron, 89s. 3d.; cast-iron railway chairs, 94s. 3d.; medium cast iron, 77s. 3d.; light cast iron, 72s. 3d.

(NOTE.—*For deliveries of cast-iron scrap free to consumers' works in Scotland, the above prices less 3s. per ton, but plus actual cost of transport or 6s. per ton, whichever is the less.*

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REQUIRED, immediately, Technical Sales Representative for Light Alloy Foundry; experience of trade necessary, with preferably some knowledge of metals.—Write, detailing experience and salary required, to Box 820, FOUNDRY TRADE JOURNAL, 3, Amersham Road, High Wycombe.

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FOR SALE.—Shot-Blasting Cabinet; reconditioned; interior 4 ft. 11 in. by 3 ft. by 2 ft. 9 in. deep; door opening 3 ft. 2 in. by 2 ft. 11 in.; suitable for 100 lbs. pressure; approx. shot capacity, 1 cwt.—COMMERCIAL STRUCTURES, LTD., Staffa Road, Leyton, London, E.10.

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One	12	6	×	4	9	1,300	100
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500 cub. ft., ROBEY, vertical, twin cylinder; two stage, water cooled, 100 lbs. pressure; driven by 100 h.p. Bruce Peebles motor, 400 volts, 3-phase, 50 cycles; with Starter, Auto unloader, Intercooler, Pump and Receiver.

300 cub. ft., HOLLAND/SLM; rotary, water cooled, two stage; 150 lbs. pressure; complete with Auto unloader, Intercooler, extended Bedplate and Receiver.

175 cub. ft. ditto machine and accessories.

175 cub. ft., TILGHMAN, vertical, single cylinder; water cooled, two stage, 100 lbs. pressure; Auto unloader, Receiver, Intercooler; belt drive.

130 cub. ft. BRACKET; vertical, twin cylinder; water cooled, 100 lbs. pressure; Auto unloader, Receiver; gear driven from 3 h.p. motor, 400 volts, 3-phase, 50 cycles, with Starter.

100 cub. ft., BROOM & WADE, vertical, single cylinder; water cooled, 100 lbs. pressure; Auto unloader, Receiver; belt drive.

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50 cub. ft., AEROGRAPH, vertical, twin cylinder; water cooled, 100 lbs. pressure; Auto unloader, Receiver; belt drive.

45 cub. ft., vertical, single cylinder; air cooled, 200 lbs. pressure; belt drive.

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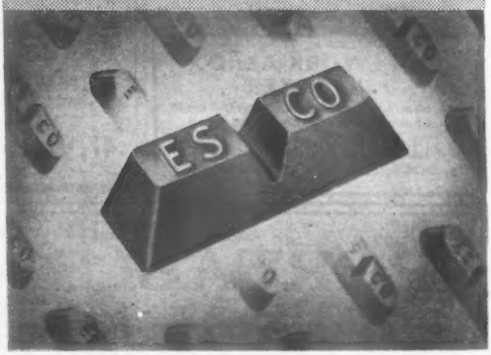

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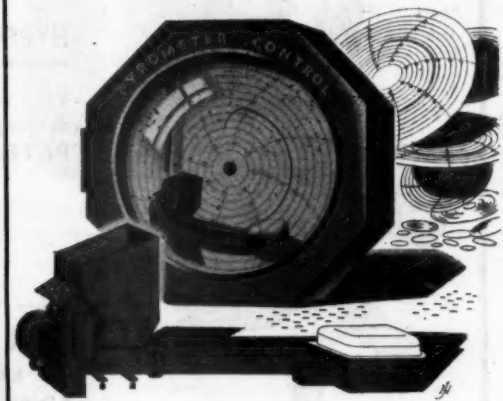

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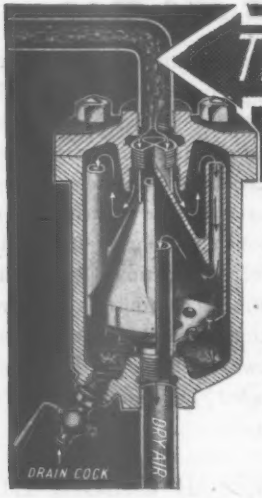

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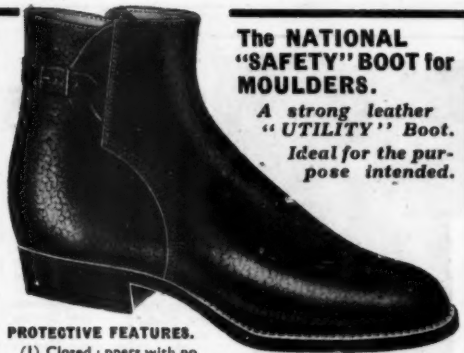

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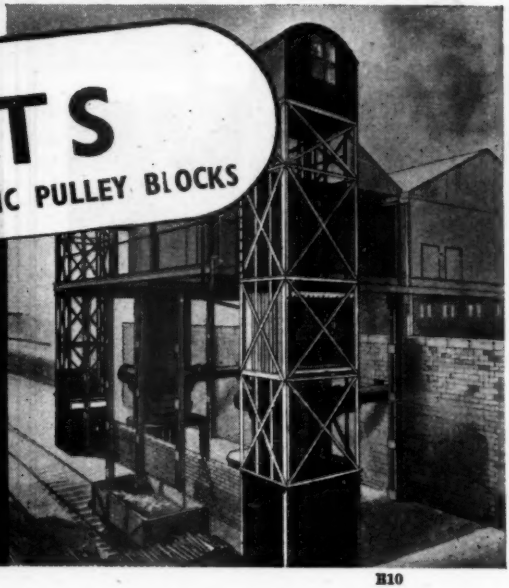

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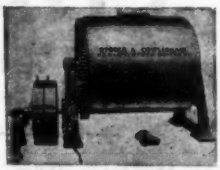

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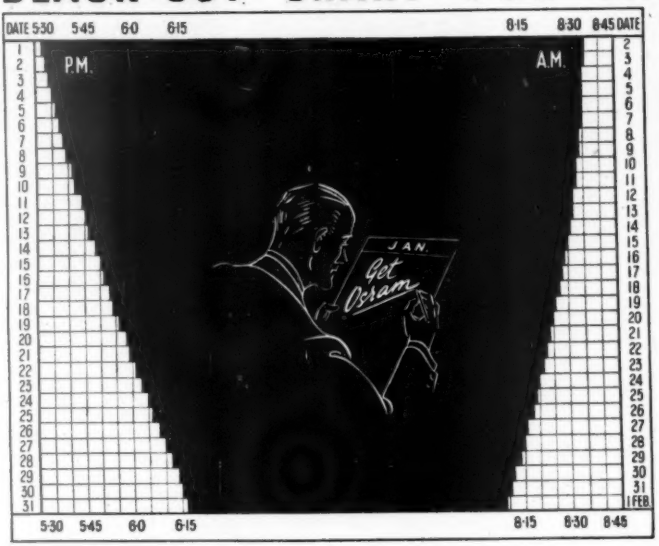
New Year Resolution

BLACK-OUT CHART FOR JANUARY



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